A GILLETTE PUBLICATION

WATER WORKS & SEWERAGE

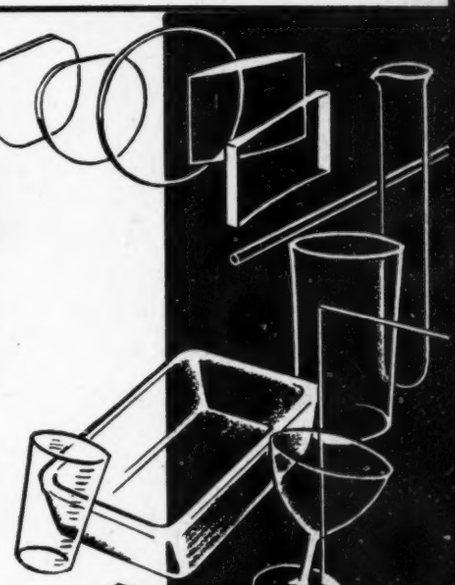
February, 1936 — Editor — Volume 83. No. 2

"CORNING n.y."

THE TECHNICAL GLASS CENTER OF THE WORLD

Corning, New York, is internationally known for the quality and diversity of its glass products. Here, in the seclusion of the sharp hills and narrow winding valleys that constitute the beauty of Southern New York State, has recently been completed a project of far-reaching scientific interest —the pouring and subsequent annealing of the largest glass telescope disc ever constructed. This disc, when finally ground and polished perhaps three years hence, will form a 200-inch mirror for the telescope to be placed in a new observatory on Mount Palomar in Southern California.

Pittsburgh Equitable is proud of its contributions to the civic and industrial progress of Corning. Pittsburgh Meters not only measure water in the 100% metered distribution system, but also gas used in many homes and industries. Corning Glass Works, the makers of the famous 200-inch telescope disc, utilize gas heat for melting and annealing operations and use Pittsburgh Equitable meters extensively.



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NEW YORK · COLUMBIA · KANSAS CITY · PHILADELPHIA · TULSA · HOUSTON · LOS ANGELES · OAKLAND

ATISTICS CONCERNING 200 INCH DISC
ished Disc
Diameter of Mirror 200 inches
Thickness of Mirror 25 inches
Weight of Mirror 20 tons
perties of Mirror
Radius of Curvature 111 feet
Focal Length 55 feet
Cassegrain Mirror 42 inches

Rough Glass Casting of 200-inch Telescope Disc, Made in Corning.

PITTSBURGH WATER METERS

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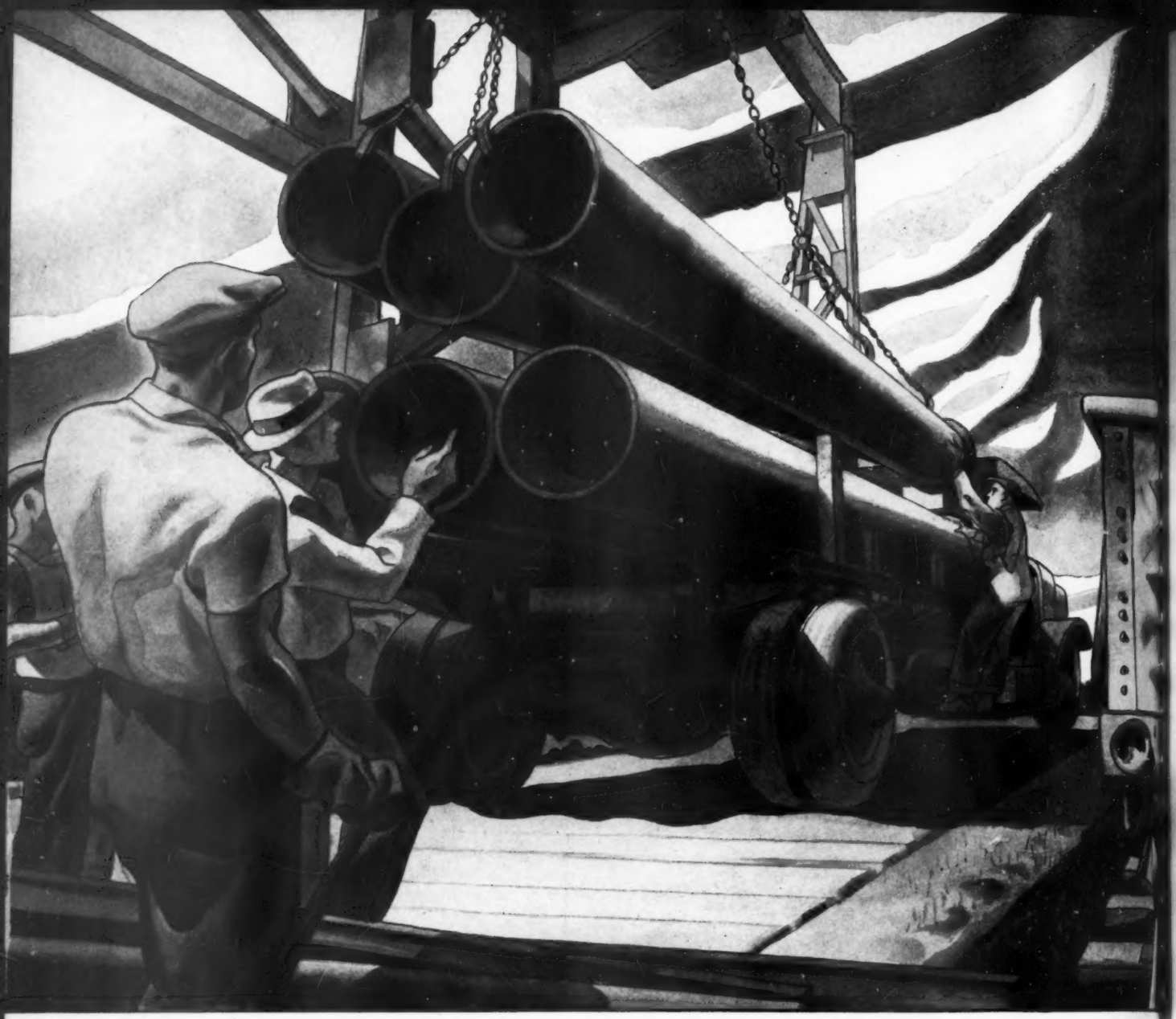
DESIGN · CONSTRUCTION · COLLECTION
TREATMENT · DISTRIBUTION · DISPOSAL

ABP



PIPE that can take punishment. U. S. Super-de Lavaud Cast Iron Pipe in 12 and 18-foot lengths—with *doubled impact resistance*—for water, gas and sewer mains. U. S. Ni-Resist* Alloy Cast Iron Pipe—for *super-corrosive* conditions in industrial processes. U. S. Threaded Cast Iron Pipe—a super-pipe for pressure, waste, vent and drainage service in industrial buildings. All three centrifugally cast without chill in a metal mold by the patented Super-de Lavaud Process. Flexible and Mechanical Joints. Pit Cast Pipe in diameters up to 84 inches. U. S. Culvert Pipe specially designed for highway drainage. Quick service from our 15 plants and storage yards throughout the country.

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WATER WORKS & SEWERAGE

E. S. GILLETTE, Publisher

L. H. ENSLOW, Editor

ARTICLES AND AUTHORS Scheduled for Future Issues

"The Economics of Various Methods of Sludge Disposal"—by Dr. Anthony Fischer, Chemical Engineer, The Dorr Company, sets forth his findings which developed in a careful study and analysis of the costs of sludge disposal by the several methods now available. Based on voluminous data, the author reaches certain rather definite conclusions as to which methods of treatment of various sludges appear to be most suitable and economical for plants of various types and capacities. His long expected article contains much needed information on the economics of sludge disposal by vacuum filtration and incineration in comparison with the more established methods. Also, is the economy and practicability of partial digestion and gas utilization in conjunction with modern mechanical dewatering evaluated against dewatering of undigested sludges.

"Pre-Treatment With Iron Salts Solves a Clarification Problem" by E. L. Zahm, Water Supply Inspector with the M. K. T. Railway Company, sets forth his experiences in treating a turbid water, difficult to clarify. The application of an iron salt to the raw-water **prior to** the addition of sodium-aluminate and lime proved the corrective in a perplexing problem in which several methods tried had failed.

"Operating Kinks"—by A. M. Rawn, Ass't Chief Engr., Los Angeles County Sanitation Districts and President of the California Sewage Works Association, constitutes a follow-up article to his previous contribution "Sewer Cleaning with Rubber Beach Balls" which appeared in WATER WORKS and SEWERAGE for October, 1935. In the forthcoming article, Mr. Rawn describes several useful "Kinks" employed in sewer maintenance and plant operation under his supervision.

"Scale and Corrosion Control in Aqueous Systems"—is to be dealt with by D. W. Haering, Chemical Engineer of Chicago, Ill. The most effective modern water corrosion control and scale prevention practices will be discussed, with especial reference to corrosion inhibitors, their relative effectiveness and methods of use in industrial plants.

"Centrifugal Dewatering of Sludges"—by Philip B. Steander, Consulting Engineer, New York City, constitutes a discussion of the underlying principles of centrifugal methods of water extraction from suspended solids. Then follows a description of the newer methods and equipment now available for centrifugal dewatering. Experiences of the past and those of today, admittedly limited, are set forth at the end of his article. Such experiences are, however, indicative of where centrifugal dewatering may fit into sewage disposal practices.

"Practical Operating Kinks" — Roger W. Esty and Nelson Boardman, Sup't and Ass't Sup't of the Danvers (Mass.) Water Department, will describe a very practical method of emptying water mains which was developed in Danvers and has proved effective in precluding or minimizing ditch pumping when cutting a line for repairs. This article is one of several to be contributed by water works operators during the year in a "Practical Operating Kink" series.

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Published monthly by the GILLETTE PUBLISHING CO., Daily News Building, Chicago, Ill.

Entered as Second Class Matter, June 2, 1931, at the Post Office at Chicago, Ill., under the Act of March 3, 1879. Published monthly at 400 W. Madison Street, Chicago, Ill. Per Copy, 25c. Subscription rates $2.00 per year. Canadian and Foreign, $3.00 per year. Copyright, 1936, by Gillette Publishing Company, Publishers of: Water Works and Sewerage, Roads and Streets, Sporting Goods Journal, Mida's Criterion, Oil and Soap, The Art of Mosaics and Terrazzo, Powers' Road and Street Catalog and Data Book, Water Works Catalog and Data Book.

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Chicago Office, 400 W. Madison Street. Cleveland Office, 1514 Cohassett Avenue, Lakewood, Ohio. New York Office, 155 East 44th Street. San Francisco Office, 155 Montgomery Street. Los Angeles Office, 318 W. Ninth Street.

Addresses will be changed as frequently as desired, upon notification; not otherwise. Changes of address should be sent in at least two weeks before the date of the next issue of *Water Works and Sewerage*, in order for them to be effective for that number. Immediate notice should be given of any delay in the receipt of the magazine.

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THERE are no substitutes for experience and for proved performance. That is why more and more engineers are specifying Norton Porous Mediums.

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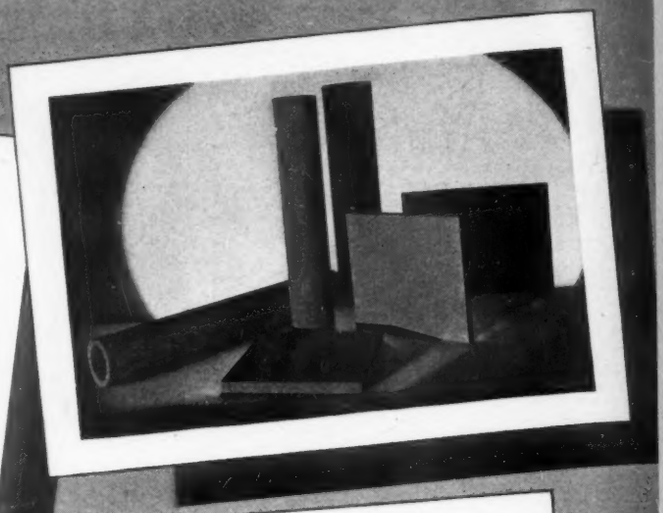

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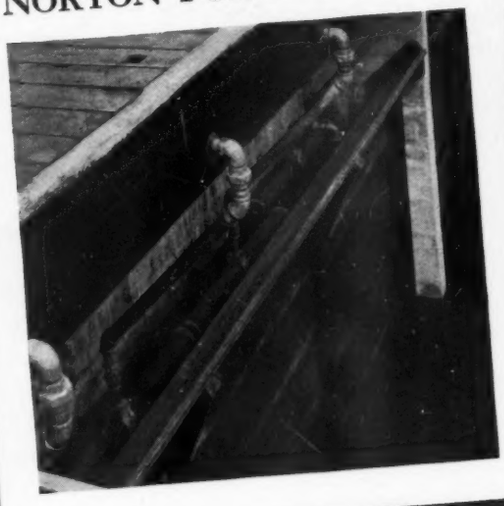

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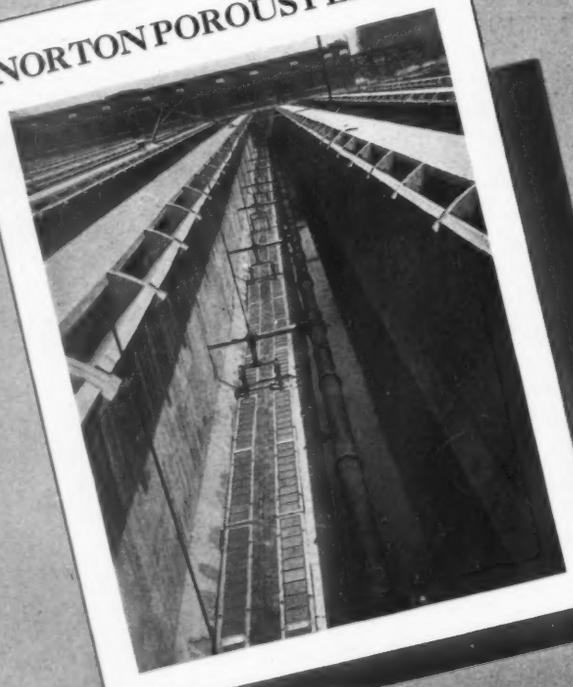

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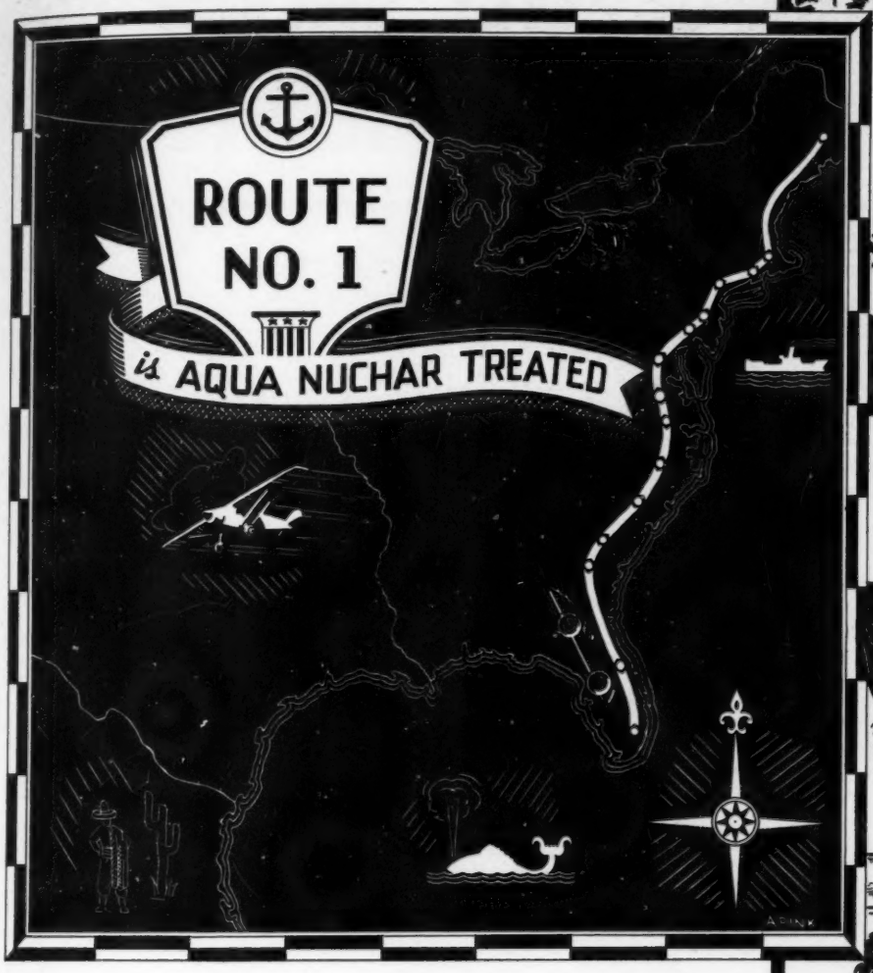

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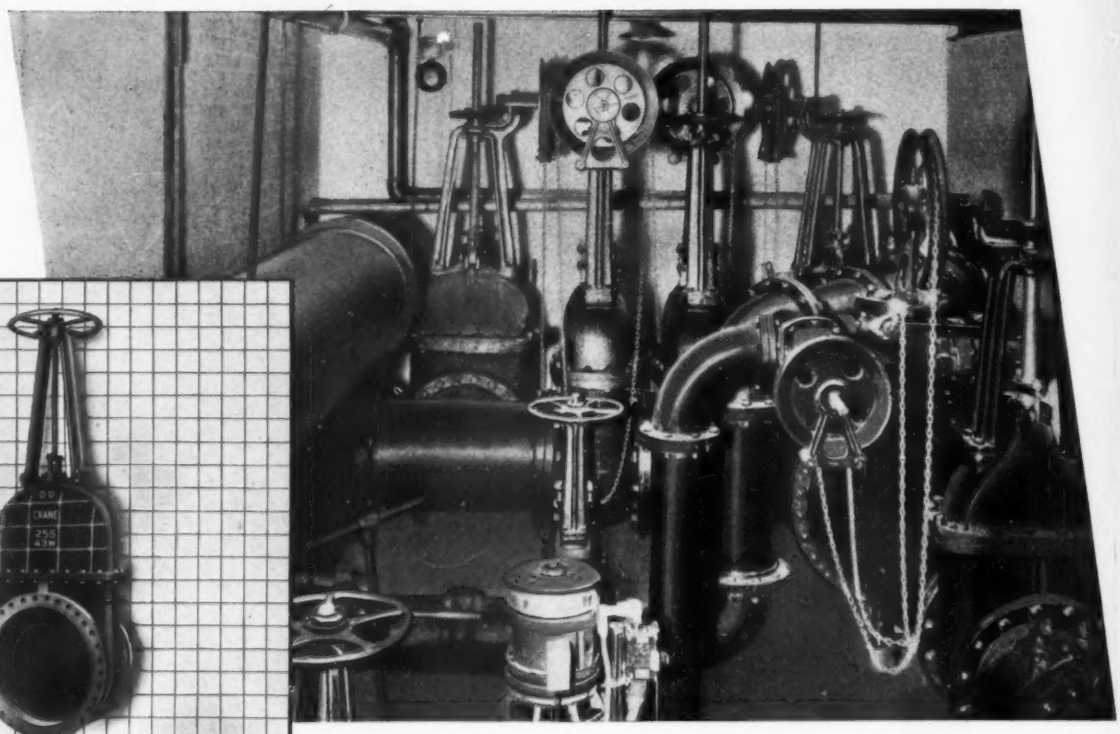
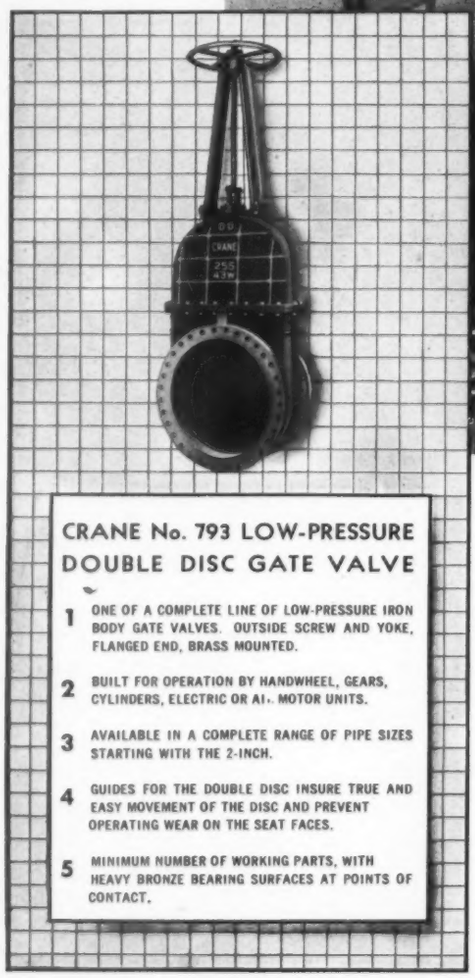


Crane Valves in a modern Filtration Plant



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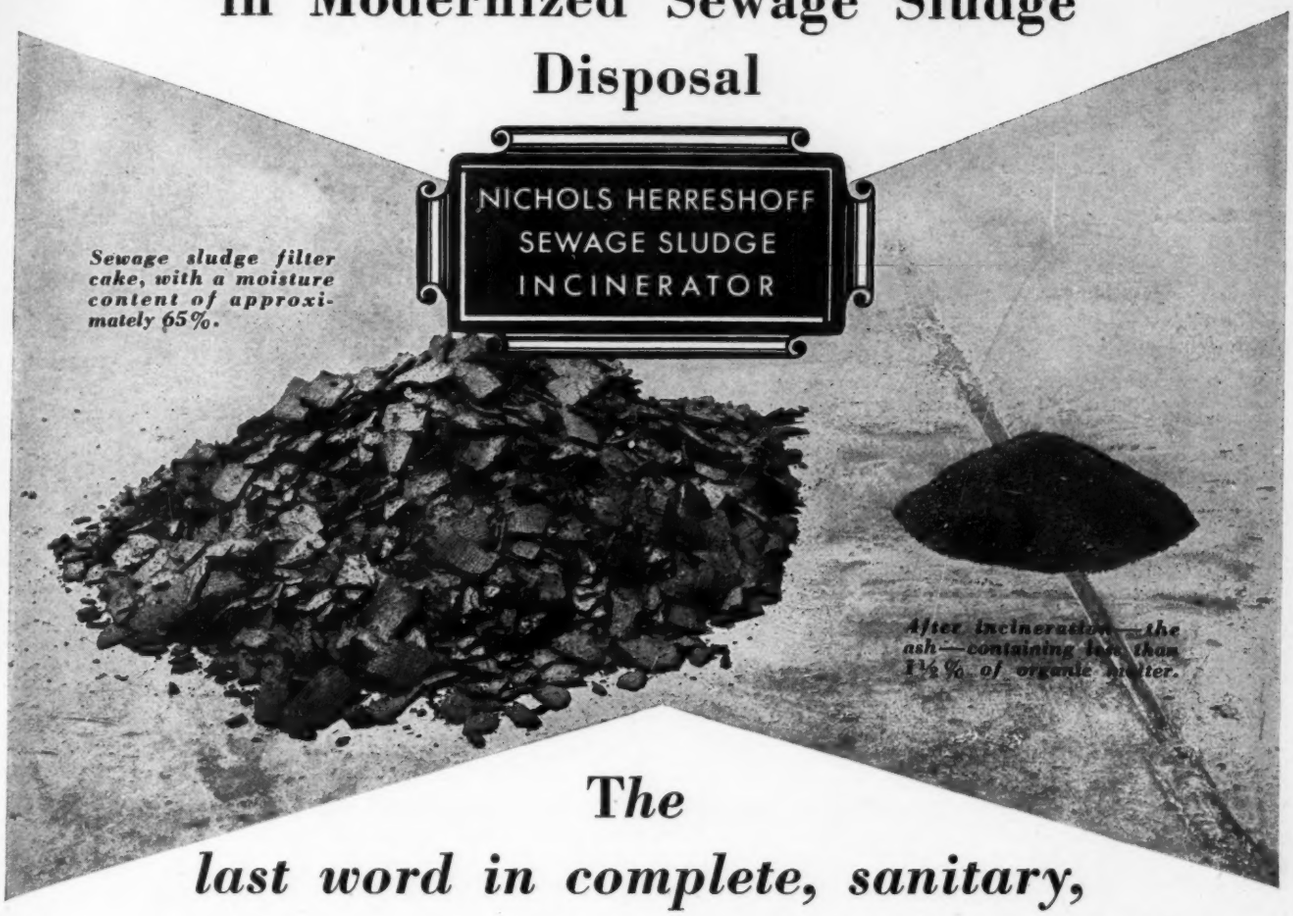
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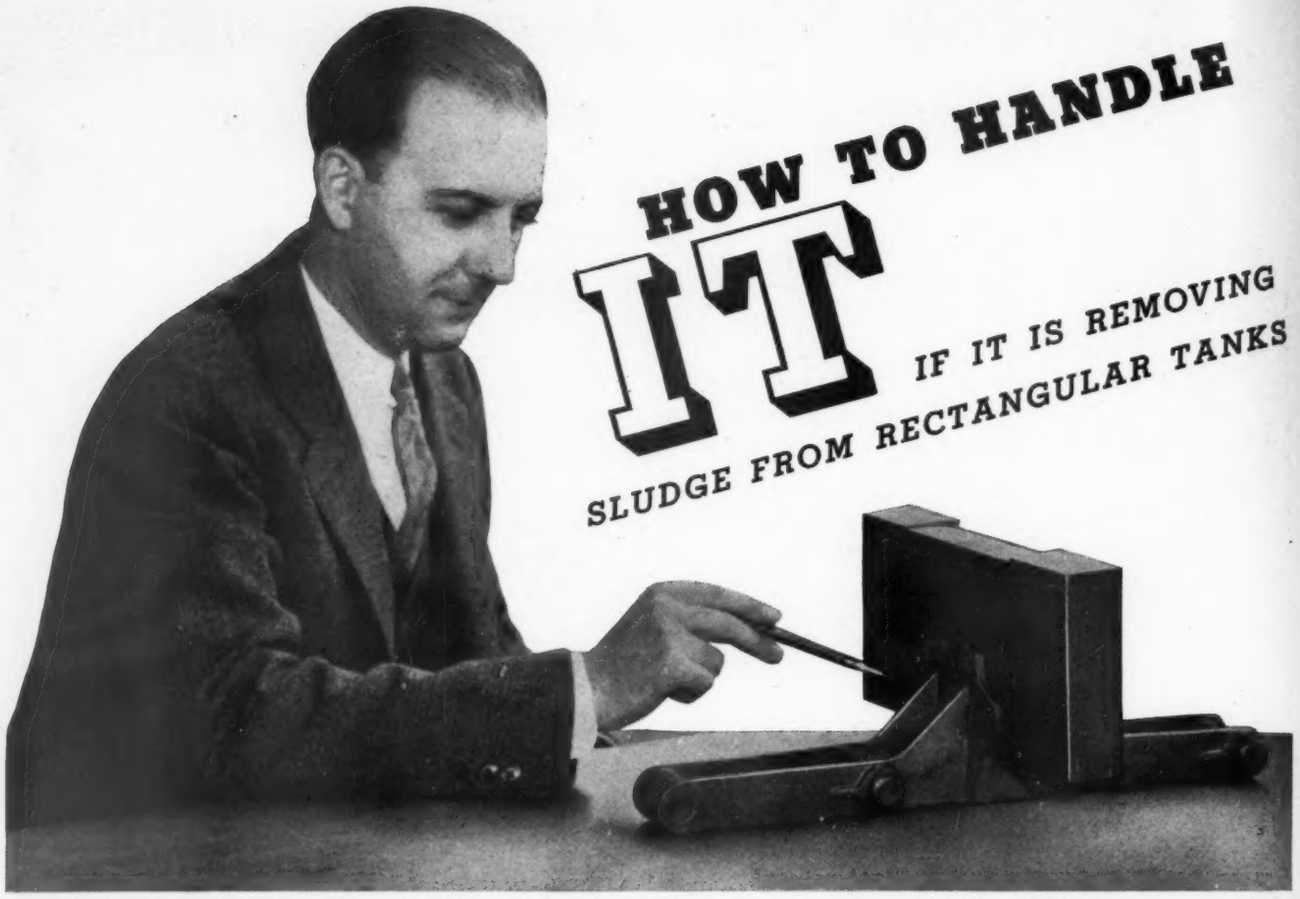

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IF IT IS REMOVING SLUDGE FROM RECTANGULAR TANKS

Use a Rex Conveyor Sludge Collector with Z-Metal Chain

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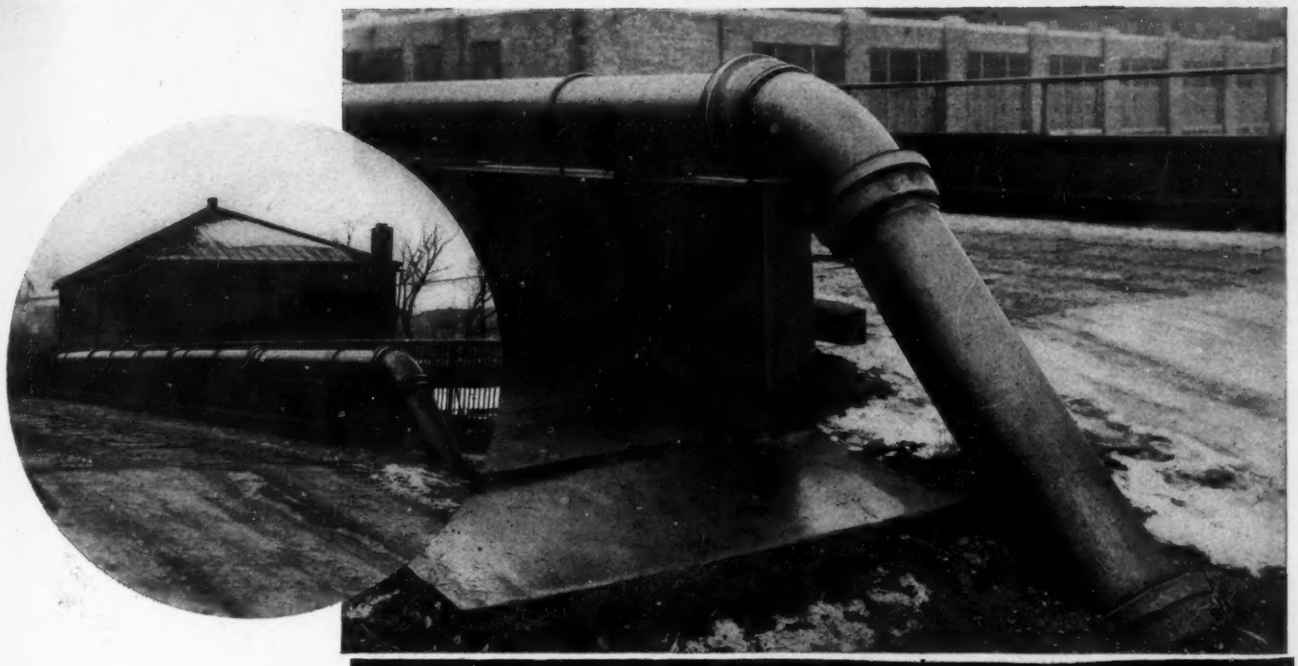

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but the vibration doesn't bother MINERALEAD *Jointing!*

This bridge, crossing the canal at the foot of Chestnut Street, Reading, Pa., is not a modern structure of concrete or steel.

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Note MINERALEAD'S further advantages, listed above at the right.

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• • •

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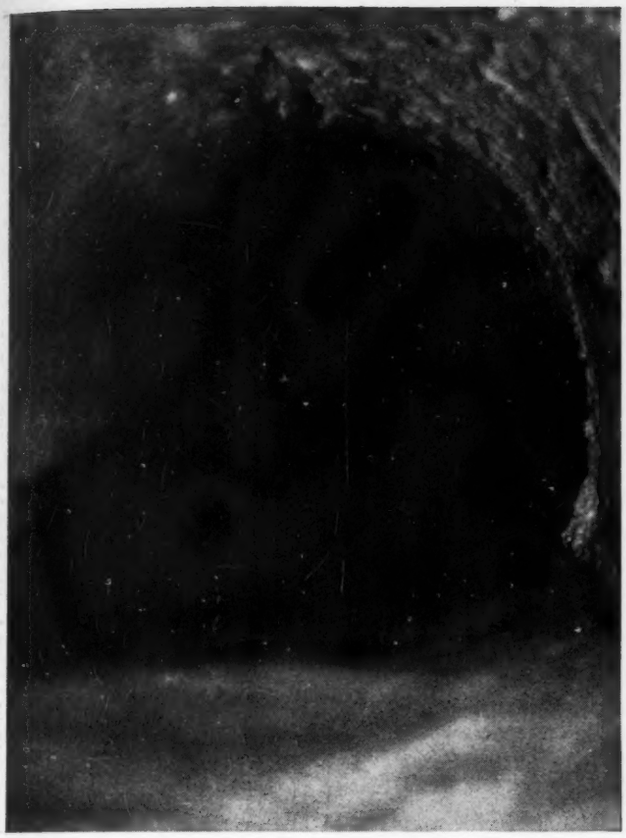
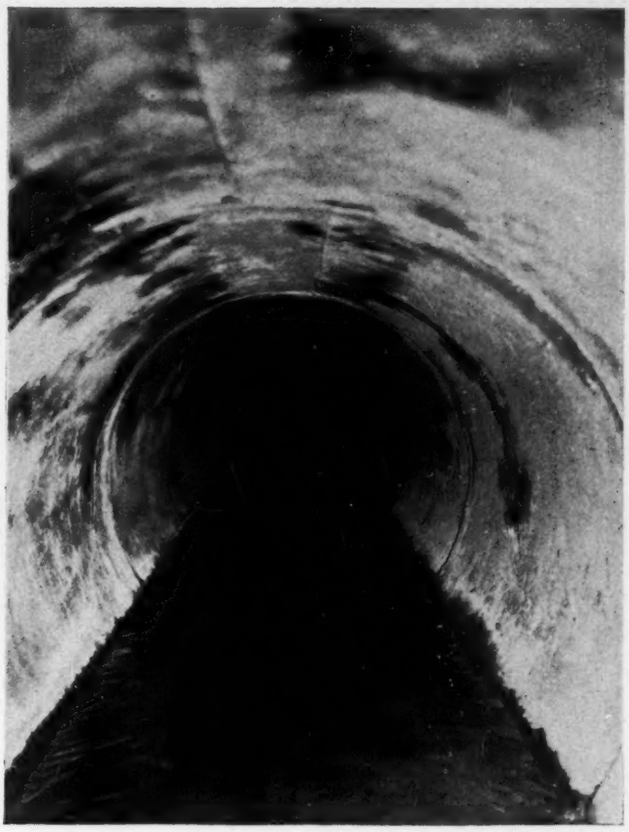


1887 *This concrete pipe sanitary sewer has been in continuous service for 48 years. Concrete is still smooth and dense—sewage scum shown on arch.*



1935 *Section of the new 48-inch concrete pipe interceptor through soft fill. A fine piece of engineering and construction. Infiltration is practically nil.*

Cedar Rapids knows

Concrete Pipe is Best for Sewers

CEDAR RAPIDS is now completing a program of sanitary sewer and sewage works construction which has been in continuous progress since 1929. The program is based upon a definite city plan and zoning laws which indicate the probable trend and growth of business and home occupancy for a forty-year period. The intercepting sewer construction is especially interesting because of the methods used and the general *adoption of precast concrete pipe.*

The new sewer relieves the load of an *old concrete pipe interceptor constructed in 1887*, one of the earliest precast concrete pipe jobs. Frank Barta, Superintendent of Sewers for 45 years, states that he has never had occasion to repair the line, which, until five years ago, carried all of the East Side sewage of the city. Though frequently overloaded, *this 48-year-old sewer is still in good condition.*

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A super-refractory ware made from a highly refined, electrically fused, crystalline alumina—the same material used in producing Aloxite Brand Diffuser Plates and Tubes.

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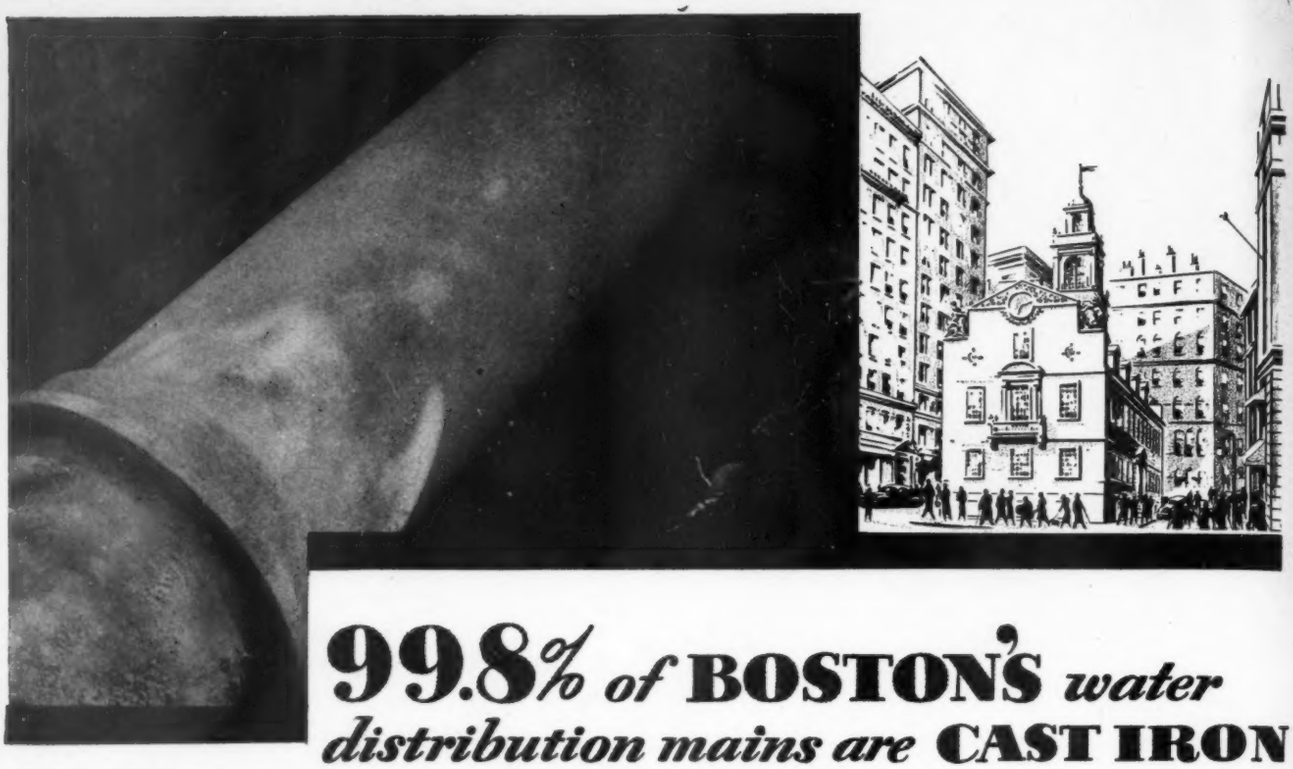


99.8% of BOSTON'S water distribution mains are CAST IRON

Section of Boston's first cast iron water main laid in 1847. It is still in service.

The following tabulation shows the percentage of cast iron pipe used in the water distribution systems of the 15 largest cities in the United States as reported in 1935 by their Water Departments.

CITY	PERCENTAGE
New York	97.2
Chicago	100.0
Philadelphia	98.3
Detroit	98.7
Los Angeles	74.0
Cleveland	98.9
St. Louis	98.7
Baltimore	99.7
Boston	99.8
Pittsburgh	97.9
San Francisco	76.8
Milwaukee	100.0
Buffalo	99.8
Washington D.C.	98.8
Minneapolis	95.8

THE City of Boston secures its water from the Metropolitan District Commission which supplies 18 cities and towns in the metropolitan area. In 1934, Boston used an average of approximately 89 million gallons daily, equivalent to 110 gallons per day per capita. The distribution system contains 12,034 hydrants and 15,431 valves; the high pressure fire system consists of 18.5 miles of pipe with 510 hydrants. Both systems combined contain nearly 1000 miles of pipe of which 99.8% is cast iron pipe.

The average percentage of cast iron pipe in the water distribution systems of the 15 largest cities in the United States is 95.6%. Cast iron pipe is the standard material for water mains. It costs less per service year and least to maintain. Its useful life is *more than a century* because of its effective resistance to rust. It is the one ferrous metal pipe for water and gas mains, and for sewer construction, that will not disintegrate from rust.

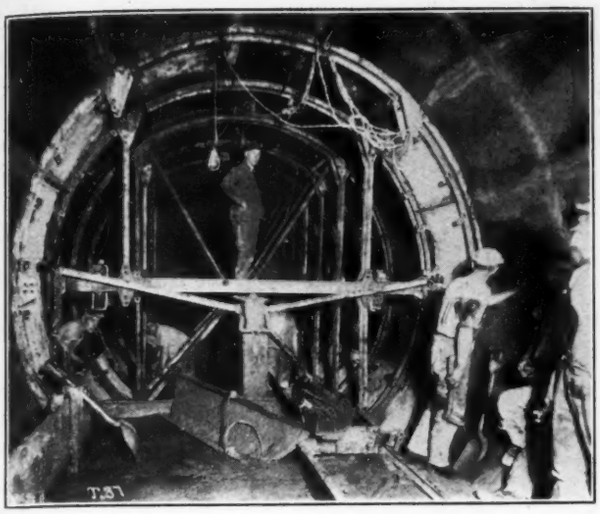
For further information, address The Cast Iron Pipe Research Association, Thos. F. Wolfe, Research Engineer, 1015 Peoples Gas Building, Chicago, Illinois.

CAST IRON PIPE

METHODS OF EVALUATING BIDS NOW IN USE BY ENGINEERS RATE THE USEFUL LIFE OF CAST IRON PIPE AT 100 YEARS

TRADEMARK REG.

WATER WORKS AND SEWERAGE
A GILLETTE PUBLICATION
VOL. 83 FEBRUARY, 1936 No. 2



Sewer Construction in Tunnel, Detroit, Mich.

A REVIEW OF SEWAGE DISPOSAL IN THE UNITED STATES AT THE CLOSE OF 1935

By SAMUEL A. GREELEY*

Chicago, Ill.

The Author

WITH the closing of the year it became apparent that many large sewage disposal projects in the United States were on the way to completion in the relatively near future. It is true that the general plans of most of these large projects had been prepared for many years. But it is a significant aspect of the past year that these large undertakings, which were available when federal financial assistance became procurable through PWA in the latter part of 1933, had progressed into active construction by 1935. The engineers and public authorities who conceived and initiated these immense works can take proper satisfaction in the approaching completion of many of them.

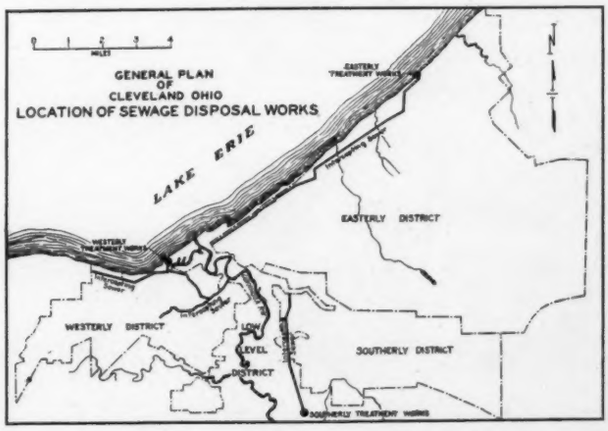
Among the cities at work on the larger projects are New York, Chicago, Detroit, Los Angeles, Cleveland, Buffalo, Washington, Minneapolis, St. Paul, Columbus, Denver and Atlanta. An appreciation of the extent of these projects can be had by examining the general outline plans of the Minneapolis and St. Paul, the Cleveland, and the Chicago projects.

With those projects taken into count that are now well under way, the status of sewage treatment at the close of 1935 for 107 large cities and special districts in the United States, with populations in excess of 100,000 in 1930, is approximately shown in Table I. Roughly, plant capacity to an extent that partial, if not complete, treatment of sewage to meet 60 per cent of the needs of the present population of the larger cities of the country will have become a reality and in operation in a short time.

TABLE 1

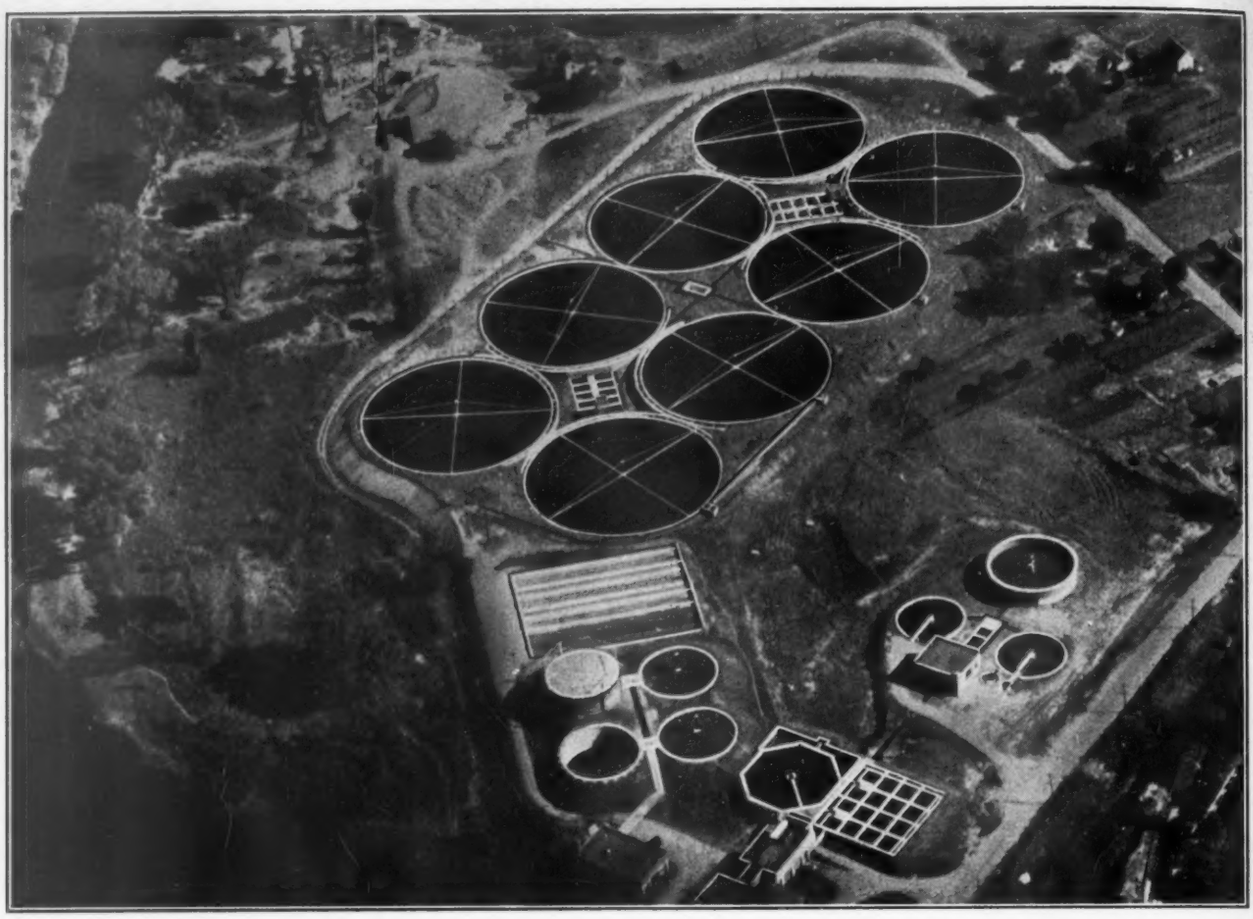
Approximate Population for Which Existing Treatment Plants Have Been Designed in 93 Cities and 14 Special Districts Having Populations of over 100,000 Each and a Total Population of About 40,000,000 in 1930

Method of Sewage Treatment	*Population for which existing Treatment Plants were designed*
Fine Screens	4,311,000
Sedimentation	10,211,000
Chemical	1,165,000
Trickling Filters	2,566,000
Activated Sludge	7,697,000
	25,950,000



General Plan, Cleveland Sewage Disposal Project

*Of Greeley & Hansen, Consulting Engineers, Chicago.



The New Combination Treatment Works of Cedar Rapids, Ia. In the Right Foreground Is the Chemical Treatment Plant Which Provides Load Reducing Treatment of Packing Plant Wastes, the Effluent Being Added to the Settled Domestic Sewage Going to the Circular Trickling Filters

Serving as projects to provide employment and to stimulate the building industry, these sewage disposal works appear to have been well suited to a public works program for combating a depression resulting from restricted private work. Although detailed plans and specifications had to be prepared rapidly to meet the emergency, a large amount of useful and unusual engineering procedure was unfolded.

In a surprisingly large number of the major projects under way in 1935, it was found desirable to build considerable portions of the large intercepting sewers in tunnel. In Los Angeles and in Minneapolis and St.

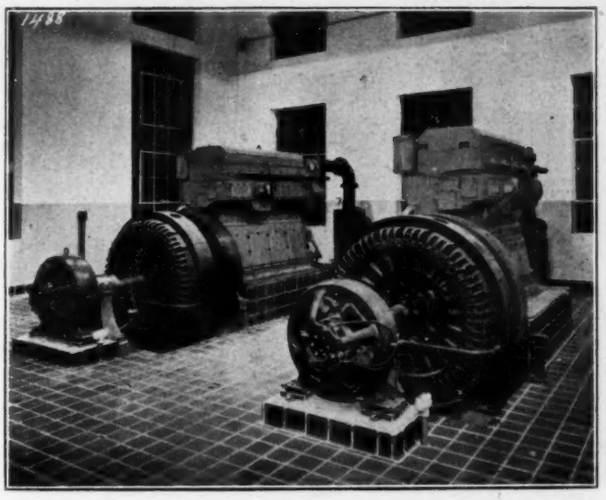
The New Coney Island (N. Y.) City Sewage Treatment Plant, Capacity 35 M.G.D.—To Provide Seasonal Chemical Treatment. View from Chemical Building.

Paul, the main outfall sewers or interceptors include some seven and seven and one-half miles of tunnel respectively. In the Chicago Sanitary District sewers in tunnel were under construction in 1935 at an estimated total cost of around $17,000,000. Much of interest has developed in the preparation of specifications including methods of payment and in the handling of water and placing of concrete during construction; with resulting favorable and equitable costs.

A notable event in 1935 was the effort, sponsored by PWA, beginning in September, to have a vast number of projects under construction by the middle of the following December—that is, within a period of less than three months. The procedure taxed the best efforts of engineers and public officials, and called for much hard overtime work; but, the planning under pressure appears to have come through surprisingly well.

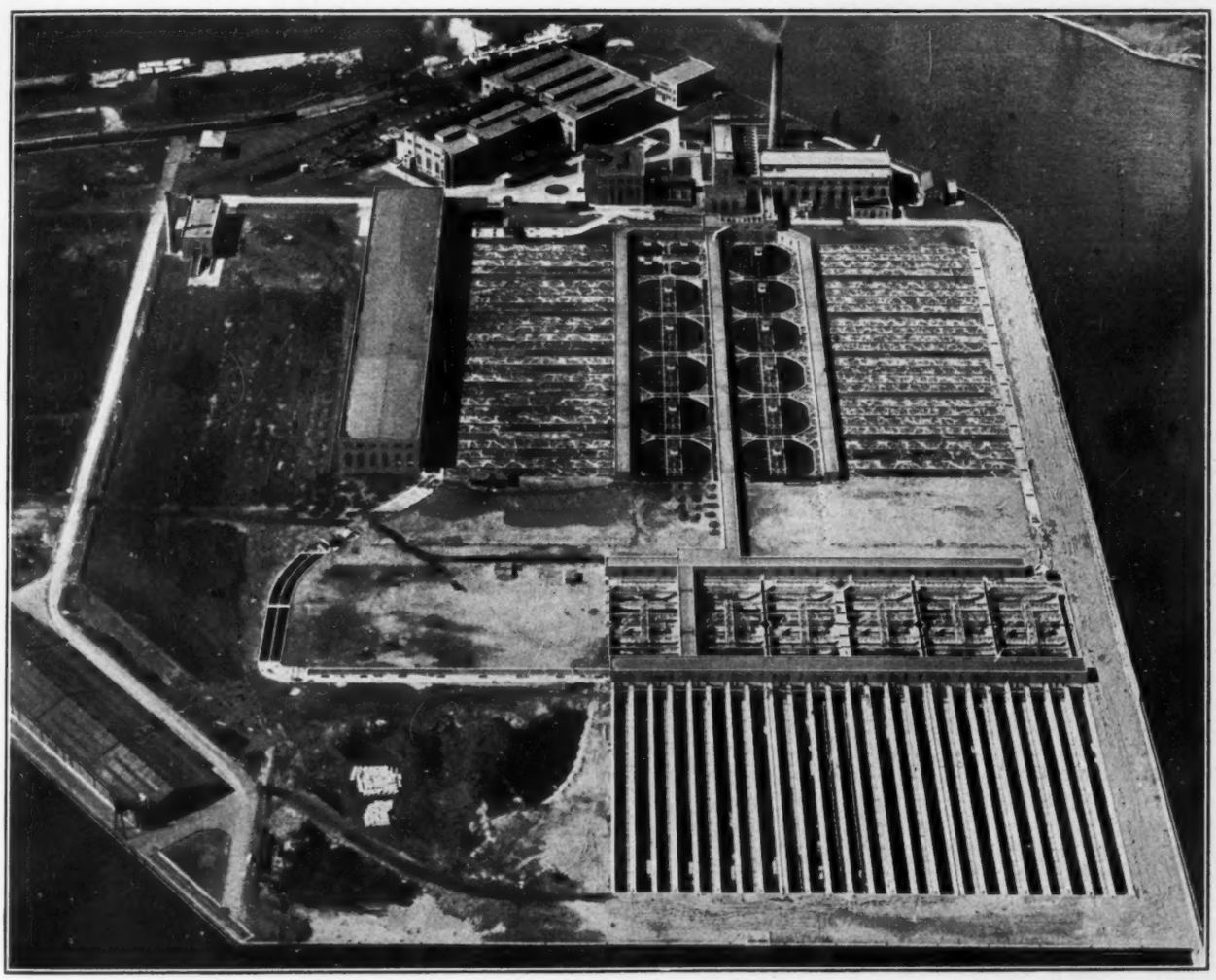
Power Generation and Sludge Incineration

In the important field of sludge disposal, the year 1935 witnessed a growing confidence in the method of sludge disposal by mechanical de-watering on vacuum filters, with incineration of sludge cake. Contracts have been let by the Sanitary District of Chicago for large installations of sludge incinerators coupled with power production; and the method has been adopted for early installation by the Minneapolis and St. Paul Sanitary District. This method of sludge disposal has also been included in smaller installations. As yet, the only full sized sludge incinerator in successful routine operation is that at Dearborn, Michigan. [For a description of this plant and operating results see WATER WORKS AND SEWERAGE for August, 1935.—Ed.]

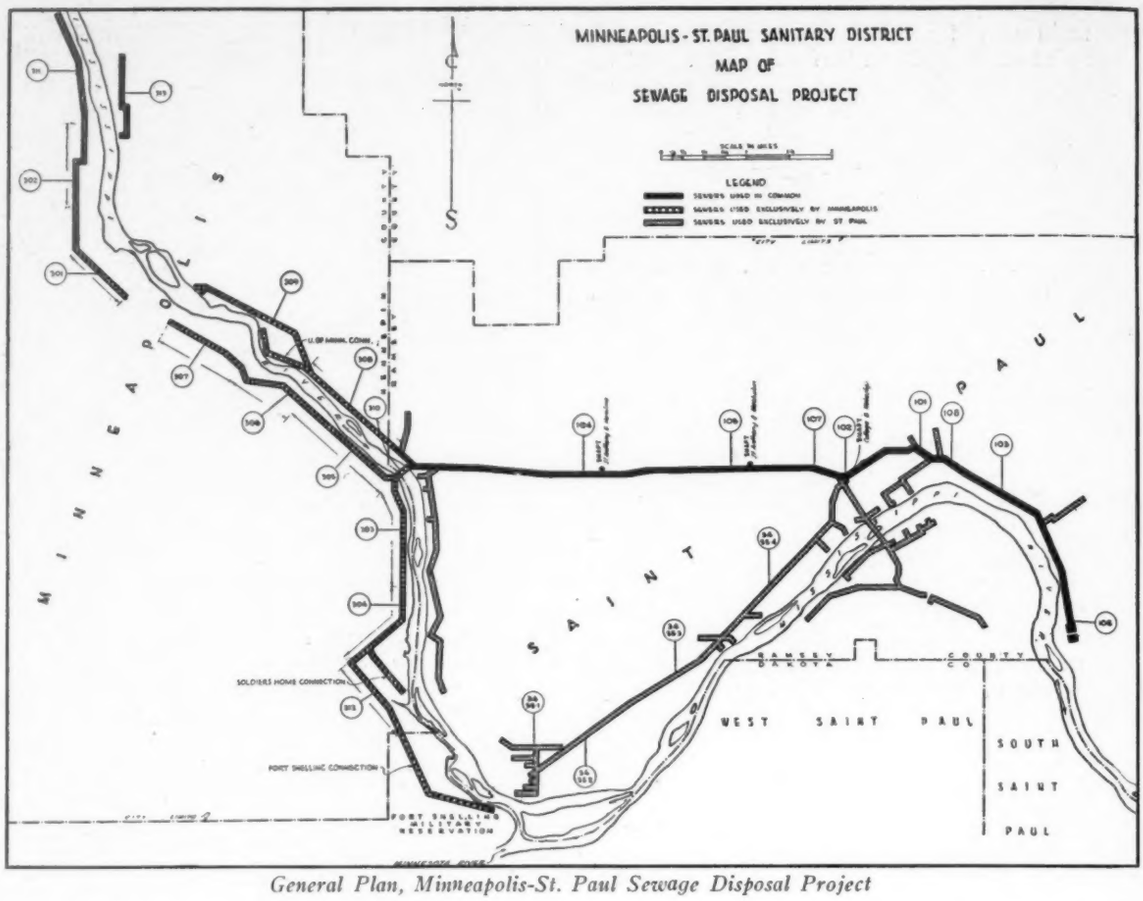


Twin Gas Engine Installation at Durham, N. C.

Sludge digestion in separate tanks continues to be used, with an increasing number of plants making some use of the gas for power production. The large gas-engine plant for the District of Columbia is under full construction. An admirable plant went into operation at Durham, N. C., and gas engine installations were also



View of the Recently Enlarged Milwaukee Activated Sludge Plant. Addition of Aerators and Final Settlers Show in the Lower Half of the Picture. Fertilizer Plant in Center Background, Showing Boat Loading



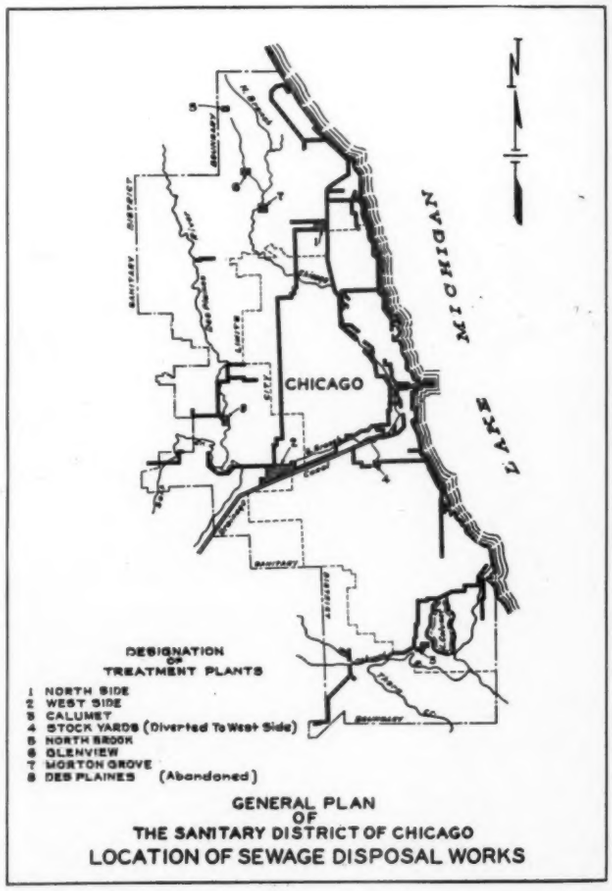
General Plan, Minneapolis-St. Paul Sewage Disposal Project

well advanced in 1935 at Madison, Wis., Chicago Heights, Ill., Peoria, Ill., at the Coney Island plant in New York City, at Ann Arbor, Mich., and elsewhere.

Chemical-Mechanical Treatment

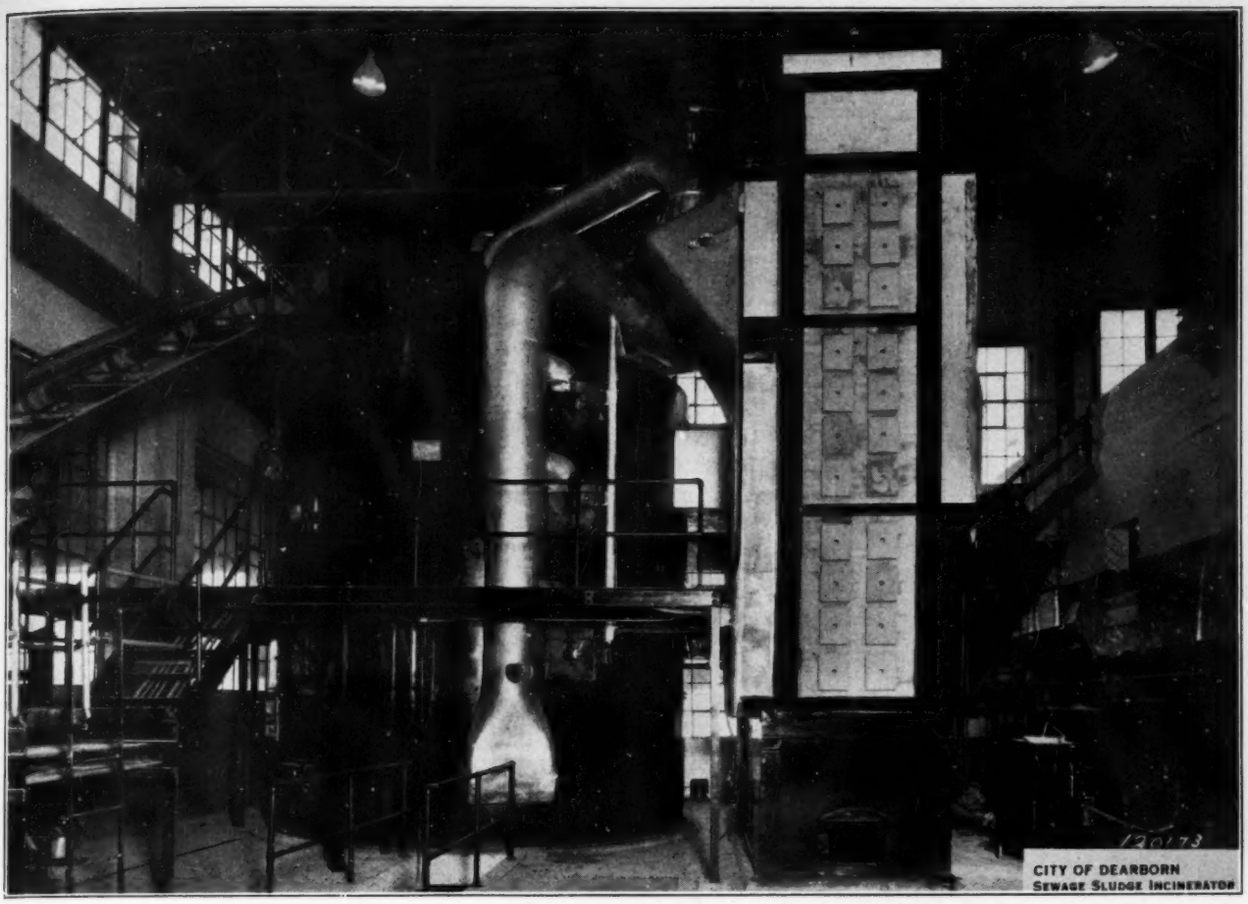
The operation of effluent filters of the Laughlin magnetic iron ore type, which were first installed at Dearborn, where they now have been in operation for several years, continued to be developed. A new installation at Perth Amboy, N. J., went into operation in the early summer of 1935. A considerable amount of experimental work with this device has been going on, including plant scale test runs at Perth Amboy, and further work has also been conducted at the small Coney Island (N. Y.) testing station. Effluent filtration and the Laughlin filter have attracted marked interest as an adjunct to sedimentation, both with and without chemicals.

A number of new chemical treatment plants have been put under construction in 1935, more especially in places where the river conditions do not require the continued use of chemicals throughout the year and, sometimes, not every year. The chemical treatment plant at Perth Amboy is the only sizeable new plant of this type to go into operation in 1935. The 35 M.G.D. Coney Island plant which went into operation in 1935 will use chemicals in the summer of 1936. A novel method of chemical treatment is the so-called Guggenheim process, which differs from the earlier Guggenheim process. It was first developed on a small scale in New York and later at New Britain, Conn., where shortly a full scale plant is to be built. The process, which is a combination of chemical precipitation with iron salts and aeration, assisted by controlled sludge return, appears to yield a very satisfactory effluent.



General Plan, Sanitary District of Chicago Sewage Disposal Project

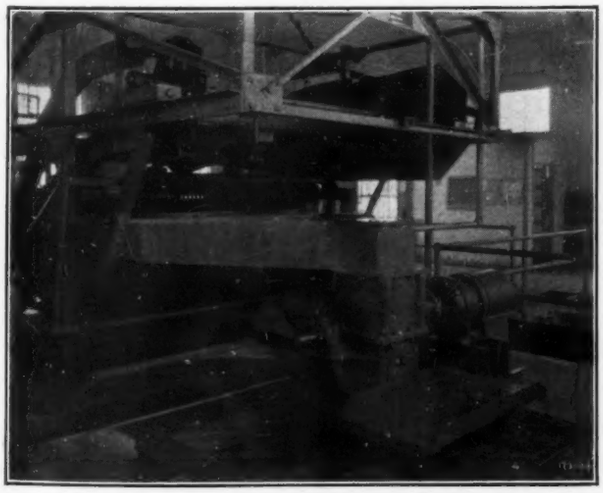
Water Works and Sewerage—February, 1936



Sludge Incinerator at Dearborn, Mich. The First Large Scale Installation in Service to Date

Garbage-Sewage Disposal

The disposal of garbage solids with sewage solids has been further exploited during the year, notably at Durham, N. C., and Indianapolis, but no actual installation has been projected. A number of trial kitchen grinders have been installed for delivering ground garbage direct to the sewers. Experimental research in the digestion of ground garbage with sewage sludge has been reported by Calvert at Indianapolis, by Keefer at Baltimore, by Babbitt at the Sewage Testing Station of the University of Illinois Engineering Experiment Station, and others. [A report covering large scale experiments at Indianapolis is to appear in an early issue of WATER WORKS AND SEWERAGE.—Ed.]



Screenings Grinder at the Cleveland, Ohio (Westerly Treatment Plant.

There has been some discussion of the possibilities of incinerating garbage with sludge cake, but as yet no actual trial or experiment.

Sewer Service Charge System Grows

The stimulus of PWA financial assistance extended to scores of small sewage disposal projects as well as to the large undertakings. Many of the loans are being financed by the collection of service charges from sewer users—a relatively little used method of financing sewage disposal projects which is just beginning in 1935 to have an extensive trial. Under this method projects ranging in size from 1,000 to 500,000 people are included. The schedules for charges are varied, including flat rates, percentages of the water bill and rates computed against the use of water, sometimes with an adjustment for sprinkling water. The volume of experience with the administration and collection of charges for sewage disposal is limited and there is very little record in the way of court and commission decisions regarding the equity of various schedules covering such items as the division of the charges between vacant and used property or the charge to large industries. The large increase in the number of sewage disposal works has caused a number of municipalities to make special agreements with industries as to the amount to be paid for sewage disposal service as, for instance, at Cedar Rapids, Ia.; Fond du Lac, Wis.; Oklahoma City, Okla.; Durham, N. C., and elsewhere.

The Trickling Filter Returns to Favor

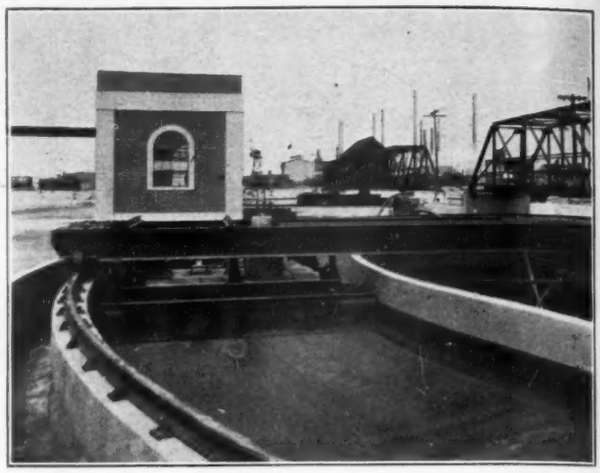
In connection with the smaller sewage disposal plants, especially, the use of trickling filters with the low head consuming and odor minimizing rotary distributors has increased, with upwards of fifty new plants of this type put under construction in 1935. The distributors have ranged in diameter from 40 to 150 feet. (See photo of Cedar Rapids plant.)

Screenings Grinding

More attention has been given in 1935 than in any previous year to the grinding of screenings, or to the use of so-called "comminutor screens" of the Chicago type. A large installation of screenings grinders of the Jeffry type went into operation at the Baltimore plant in 1935 and no less than seventy-five smaller installations of grinders and comminutors were put under construction during that year. At Grand Rapids a small grinder is disposing in a satisfactory manner of screenings removed by hand from bar screens. "Comminutors" are being installed at the treatment plants at Cleveland, Ohio; Jackson, Michigan, and many other points. At Oklahoma City the comminutor serves also as the rapid mixer in chemical treatment.

Mechanical Aerators

The mechanical aeration of sewage, with activated sludge, has attracted some attention during the year. Two or three new equipments have been advanced and given some trial.. Among these were the Chicago Aerator at Monroe, Wisc., and the novel American Well Works unit at Menominee Falls and Madison, Wis. At least six relatively small plants were equipped with mechanical surface aerators during the year, and a centrally located plant of this type was formally placed in operation at Geneva, Ill.



One of the Laughlin Sewage Filters, Perth Amboy, N. J.

Stream Cleansing Programs

Inventories of stream pollution are progressing under the Special Advisory Committee on Water Pollution of the National Resources Committee and studies are being made of the Ohio River valley, the Potomac River basin and other drainage areas as to existing conditions. Policies and administrative procedures for the reduction and control of pollution under Federal, State and local authority are being considered. In its report of July, 1935, the Committee recommended the expenditure of $15,000,000 on the Potomac River system for demonstration purposes; and described a proposed River Conservancy District. Reports of the Advisory Committee on Water Pollution should be of great interest to sanitary engineers and public works officials.

The New and Attractive Small Treatment Plant at Geneva, Ill.

Battery of Wand T. Chlorinators at Richmond Plant. Two for Prechlorinative or Chlorinating Copperas; Two for Final Chlorination

SOME PRACTICAL ASPECTS OF HANDLING CHLORINE

By CHRIS F. BINGHAM*

Richmond, Va.

C. F. Bingham

THERE appeared in the September, 1935, issue of the Journal of the American Water Works Association a valuable report, dealing with chlorine, by the Committee on Chemical Hazards in Water Works. This paper is intended to record various practical experiences in chlorine handling and opinions that in their nature had no place in the above committee report. However, as will be seen, the writer quotes freely from the report, where deemed advisable, and recommends that those interested procure a copy of the journal containing it.

Properties of Chlorine

As may be seen from the accompanying table of chlorine constants (See page 41) chlorine gas is approximately two and one-half times as heavy as air at normal temperature and pressure, and hence, tends to settle and collect in low places and leaking chlorine will accumulate on the floor of an enclosed room.

Chlorine is neither flammable or explosive. The dry gas does not attack iron, copper, or lead at ordinary room temperature. However, in the presence of moisture it is very corrosive and combines readily with most metals except those classed as the "noble" metals and special alloys. It is important to note that even the dry gas becomes very corrosive at temperatures above 300 degrees F. and is likely to become so at temperatures as low as 195 deg. F.

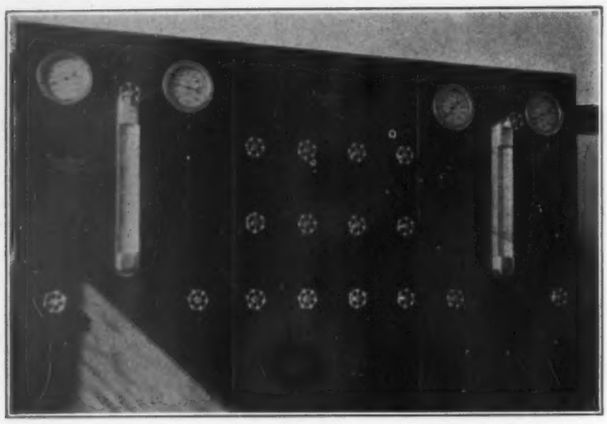
Chlorine Lines

Rubber and the noble metals are sufficiently resistant to the action of wet chlorine to be satisfactory materials to handle either the moist gas or water solutions. Liquid chlorine, however, cannot be used with hard rubber. During the last year and a half plant tests have been made in Richmond to determine the resistance of asbestos-cement pipe to chlorine solutions. As a result, the prechlorination and copperas chlorine solution systems have been rebuilt using two and one-half inch "Transite" Class "B" pipe and Class "S" elbows. So far, this installation has given excellent service, the only difficulty encountered was due to its brittleness and the lack of sufficient mechanical support—a few sections of the pipe being broken by strains before adequately supported. The chlorine solution seems to "wet" the inside of the pipe to a depth of ⅛ to 3/16-inch and then stop, no further change was noted in the experimental installation or in the new permanent installation after two months of heavy use.

Extra heavy iron pipe with wrought iron fittings and litharged joints should be used for the chlorine pressure lines. Litharge that has been opened for some time seems to form a carbonate coating on the particles which result in a never hardening and oily joint compound which will allow the joint to leak probably, and only new litharge is recommended. Care taken in the correct installation of pressure feed lines is a thousand fold repaid. Ammonia valves of steel have been used in the chlorine pressure lines at Richmond with satisfactory results, but where possible the standard Chlorine Institute ton container valve has been used because of its convenience, economy and superior construction. In general chlorine needle valves should have either Hastelloy "C" or Monel Metal stems, and the valve bodies may be constructed of steel, brass or Hastelloy "C".

Soft copper tubing connections (cadmium plated) are used in connecting the one ton chlorine containers to the piping system. We specify that a small wrench "hold" be milled on the bushing on the tubing itself to allow holding the tube at the joint during tightening of the coupling. This, to prevent wringing off the tube at that point. The tubing becomes quite hard and rigid after continued service, but its ductibility may be re-

*Plant Supt., Div. of Filtration, Dept. Public Utilities, Richmond, Va.



Two Pardee Panel Type Chlorinators, Producing Chlorinated—Copperas for Coagulation. Note Multiple Valved Distributing Panel in Center

newed by heating slowly to a dull red heat and quenching in water—the customary method of copper softening.

Hard drawn copper fittings and pipe of the "Streamline" type also have been used with essentially *pure* silver as the solder instead of the regular solder, furnished for such pipe, which chlorine attacks. A silver coin will serve as satisfactory solder. High copper content brass fittings have been used with this type of pipe also and seem to work entirely satisfactory.

Avoiding Condensation Troubles

The gas feed lines should, if possible, always be warmer than the chlorine containers to avoid condensation (re-liquifaction of chlorine) and consequent problems. These lines should also be run on a continuous upgrade from the containers in order that the condensed liquid chlorine will flow back to the containers. Such theoretical conditions cannot always exist practically and in cases where this is impossible drip-legs should be provided at every low point on the pipe line—especially so near the chlorination. Blow-off cocks or other bleeding arrangements are not recommended since they are both dangerous and unnecessary. If the drip legs are so located that the room temperature does not keep the condensate vaporizing at a satisfactory rate, additional heat may be applied by warming with a 100 watt electric bulb permanently installed beneath the leg. The size of the leg varies with the conditions, but it is recommended to be 1¼ times as large as the volume of the pipe line leading from the chlorine container to the leg.

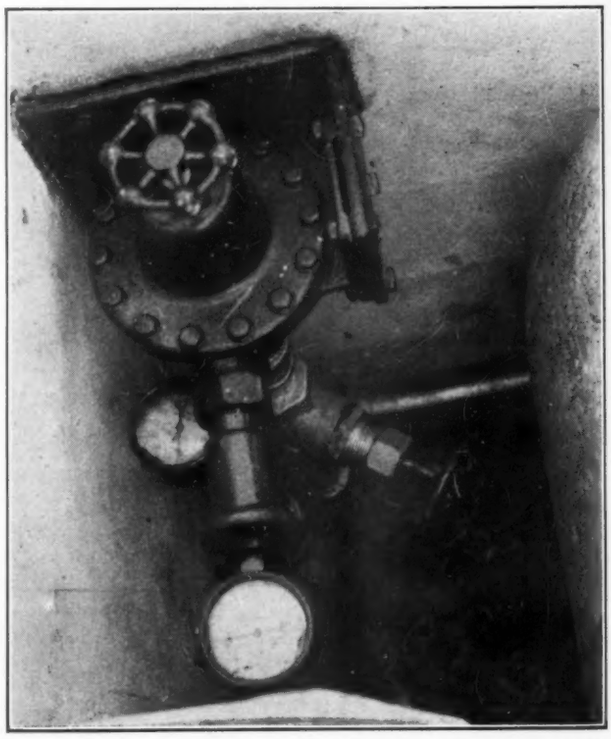
Chlorine reacts with grease and oil to form voluminous frothy substances; with gasoline and other petroleum distillates to form solid complex chlorinated hydrocarbons. Alcohol and ether, even in traces, are converted to solid waxy hexachloroethane. It is important, therefore, that all grease, moisture, etc., should be thoroughly removed from chlorine lines during their erection. Methane derivatives, chloroform, wood alcohol, and carbontetrachloride are the only safe chlorine equipment cleansers to employ.

Whereas, dry legs are very helpful, condensation in chlorine lines should be avoided. If the gas leaving the container drops only a few degrees in temperature it will condense into a liquid in the feed lines and find its way up into the chlorinators, with its consequent troubles. This condition can best be avoided by reducing the pressure at the containers to the lowest point permissible for the proper operation of the machines. In fact, if the line pressure be kept at 40 pounds per square inch or less no condensation can occur in the lines except at extreme cold temperatures. In Richmond, by keeping the reducing valves (in duplicate) set at 35 pounds per square inch, no liquefaction has resulted, although the chlorine feed lines are 400 feet long and the containers are in compartments outside of the plant which get quite warm in summer and are artificially warmed in cold weather—an ideal condition for condensation in the feed lines.

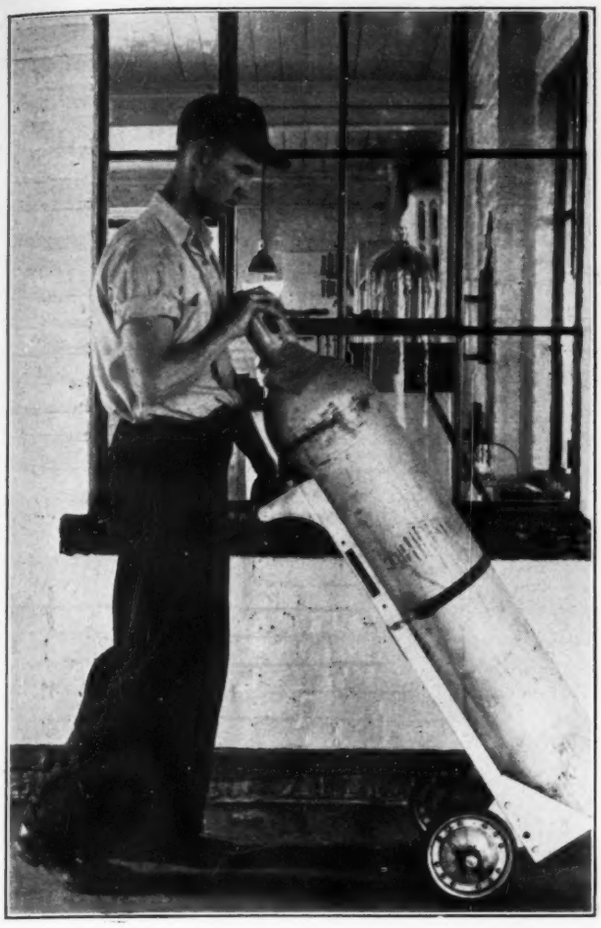
Chlorine, in distilled water, at 49.2 deg. F. will form chloralhydrate, commonly referred to as "chlorine ice." This condition is frequently found in the trays of vacuum type chlorinators during cold weather; but may be overcome by placing an electric light under the tray of the chlorinator. Since the solubility curve is a very sharp one a rise of only one or two degrees of the water is sufficient to do away with the trouble.

Container Temperatures and Pressures

The per cent of container volume occupied by liquid chlorine in the containers, when loaded to the limit permitted by the Interstate Commerce Commission regulations, is such that at 153.9 deg. F. the cylinder becomes completely filled because of expansion of the liquid chlorine. Liquids do not have the compressibility or cushioning effect possessed by gases hence any further increase in the temperature will cause enormous pressure in the containers. For this reason, fusible plugs are provided which are intended to soften at slightly above this temperature and thus relieve the dangerous pressure. It is important, therefore, to keep the cylinders below this temperature regardless of the amount of chlorine that they may contain. Experience at the Richmond plant justifies this warning. There are several practical precautions suggested by the above facts. Cylinders should never be directly heated by flame, steam or even electrical means that can exceed 160 deg. F. To avoid such hazard, warm air for the building is blown through an underground pipe to the containers used for the Richmond plant supply which are housed in compartments outside of the plant. Secondly,



One of the Reducing Valves (Looking Down) on the Chlorine Feed Lines. It is Located on the Manifold Just Beyond the Containers in the Outside Gassing Chamber



Handy Light Weight Safety Truck for Cylinder Handling (Courtesy Carl Leipold, Winnetka, Ill.)

a full cold chlorine cylinder has a lower pressure than one at room temperature; hence, if they are connected together as on a header, the cold cylinder will actually draw in chlorine. If the valve is then closed the overloaded cold cylinder may cause trouble when it becomes warm, even to room temperature. Hence, cylinders should be brought to about the same temperature before being connected together. As another example, the re-loading of containers thought to be empty, is absolutely forbidden unless under technical supervision.

If gas is drawn from a container, the pressure within the container will be reduced. If a constant supply of gas at constant pressure is to be maintained, then heat must be applied to the liquid in the container. The more rapidly the gas is removed, the more rapidly heat must enter. This is usually accomplished by increasing the room temperature. If instead of adding heat, the container is cooled—the pressure falls. This is why a leaking cylinder should be cooled as rapidly as possible. Different opinions exist as to the maximum rate that gas may be drawn from cylinders. Experiments at Richmond have indicated that as much as 800 pounds per day may be drawn from the standard one ton container, in the summer when indoors, with pressure maintained at not less than 30 pounds per square inch. However, 400 to 450 pounds per day is about the maximum successful continuous rate of supply from these containers. With the 150 pound cylinder the rate is about 30 pounds per day. Increasing the room temperature and providing air circulation will increase the rate of gassing. Especially so with a full cylinder because there is then a large area of the liquid exposed to the sides of the warmed container. Adequate air circulation is a considerable aid in maintaining sustained gassing rates.

Handling Containers

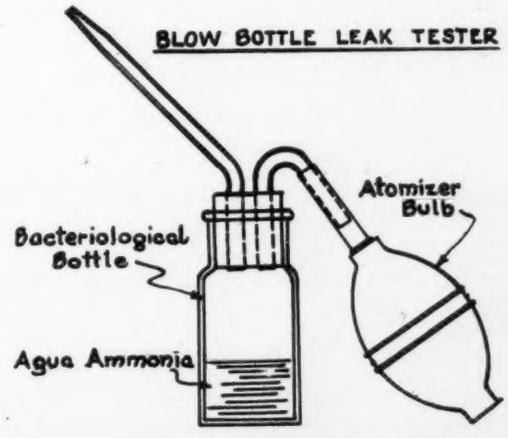
Containers are built of steel and may be safely handled with care. Dropping or bumping containers is extremely dangerous, and facilities used in handling should be carefully arranged to prevent such rough treatment. Hoisting is to be avoided if possible. Low, rubber tired trucks are preferable if conditions allow. Illustrated is a rubber tired truck for 150 pound cylinders first used by Carl Liepold at Winnetka, Ill., plant which has proven both safe and convenient. The monorail system used in Richmond for ton containers, as pictured, shows a lifting hook used to reduce space and suitable for low head operation on such a system. Out of doors storage is provided in racks, the enclosed section being the warmed gassing chamber. The maximum chlorine temperature yet found in these stored containers is 108 deg. F. or a pressure of 160 pounds which is amply safe. In warmer climates it may be well to shield stored containers from direct heat of the sun.

Chlorine may be safely stored indoors and having the containers in operation mounted near the control machine undoubtedly has its advantages. In small installations, having in storage or in use only a few 150 pound cylinders, this risk is not serious and the practice is to be recommended, but when larger quantities of chlorine are necessary the advantage of the out of door storage and gassing chamber, with only the chlorine feed lines and the machines in the building, is certainly evident.

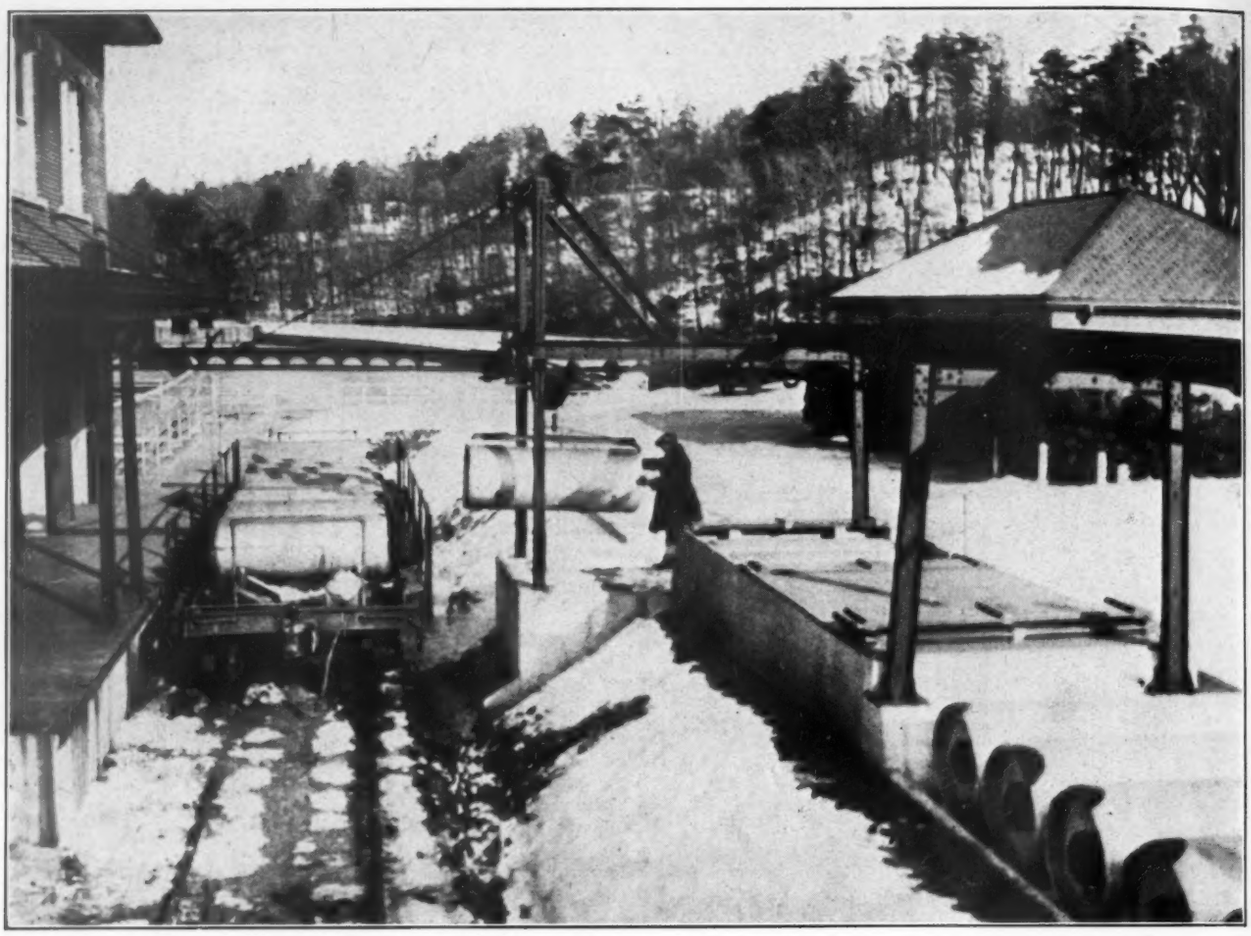
Ventilation Facilities and Leak Handling

When storage and operating containers are indoors adequate and reliable ventilation is essential. Exhaust air ducts draining air from the room should intake at the *floor level* and a fan forcing air into the room should drive the chlorine atmosphere directly out of the building. Where steam is available, a suitably designed ejector system, with discharge to a sewer or stack, is perhaps the best disposition of the escaped chlorine.

The use of neutralization tanks containing caustic or the attempting to stop a leak by spraying water on the leak or by cooling with ice and salt, while theoretically correct, are of doubtful practical value. Practically it has been found at the Richmond Plant that the best disposal is by submerging the cylinder, as for example, in the raw water flume, or other convenient large body of flowing water. "Dry Ice" (solid carbon dioxide), is the only method used successfully in cooling a cylinder to stop a leak.



The Chlorine Leak Tester



Handling and Storage of 1 Ton Containers at Richmond Plant. Note the Covered Gassing Chamber on Right Which Accommodates 4 Containers of Chlorine and 2 of Ammonia. Inside Are the Pressure Reducing Valves. The Chamber Is Heated When Necessary by Hot Air Blown Through a Duct From the Main Plant on Left

A suitable number of gas masks, of a design approved by the U. S. Bureau of Mines, should be readily available in a convenient location, and all employes should be trained in the correct procedure in putting on the masks. There is quite a prejudice among a large number of operators against the use of a mask in stopping small leaks. Contrary to general statements otherwise, that chlorine exposures produce no cumulative effects, the writer has noted cases of men repeatedly exposing themselves to small concentrations and have ended up with irritations such as results from a heavy concentration. It is well to note that the life of a canister type gas mask of the soda lime-activated charcoal type, depends not only upon the extent to which it is put to active service, but upon the storage conditions. Such canisters deteriorate rather rapidly when left open to the air and, therefore, the bottom opening of the canister should be kept sealed with the plug or disc supplied by the manufacturer. The useful life of a canister cannot be predicted and a fresh canister should always be available. Canisters should be replaced periodically, regardless of use.

Remember three simple rules in using a gas mask:

1. Never use where there is any danger of a deficiency of oxygen.
2. The life of the canister is an unknown quantity.
3. Any gas mask job is a *two man* job.

Even small chlorine leaks are dangerous and should be stopped immediately. A chlorine leak may be readily located by means of aqua ammonia. The best procedure so far found in Richmond consists of the use of a "blow-bottle" here illustrated. This is a bottle of suitable size to carry in one hand conveniently, containing a two hole rubber stopper with a small glass tube extending through one hole to a point just inside the stopper; the outer extension of this tube being bent at an angle of about 135 degrees and terminating about five inches from the bend in a small constriction. Another glass tube passes through the second hole in the bottle, the external length of about two inches bent down parallel to the bottle. A rubber atomizer bulb is attached to this tube and permits the operator to blow ammonia fumes from the bottle while holding the outlet nozzle near the suspected leak. This outfit can be easily manipulated with one hand.

Water played on a gas leak will not stop the leak, but in large quantities will assist in diluting and dissipating the gas. However, water played in a liquid leak will provide chlorine hydrate, from which hydrate the evaporation is slow. Such operations should be undertaken only by a competent person wearing an approved gas mask and such protective clothing as rubber gloves (loose fitting) and a rubber apron.

There is so much difference of opinion (See National Committee Report) as to the best Medical Treatment to be given those suffering from exposure to chlorine; and the "Do's and Don'ts" are almost as numerous; that the writer refrains from expressing any opinion for anyone elses use on this subject at this time.

CHLORINE DATA

Atomic Weight (Cl)	35.458
Molecular Weight (Cl_2)	70.916
Boiling Point:	—30.3° F. at Normal atmospheric pressure. (The temperature at which the chlorine will change from a liquid to a vapor at normal atmospheric pressure.)
Critical Temperature:	291.2° F. (The temperature above which chlorine cannot be liquefied at any pressure.)
Critical Pressure:	1117 pounds per square inch. (The pressure necessary for liquefaction at the Critical Temp.)
Latent Heat of Vaporization:	67.1 calories per gram at —34.6° C. or 112 B.t.u. per lb. at —30.30 F. (The heat required to convert the element from a liquid to a vapor at that temperature.)
Specific Heat of Liquid:	0.2257 calories per gram per degree C. between 0° and 24° C. (The specific heat herein given is the ratio of the heat required to change the temperature of a unit weight of the element one degree to the heat required to change the temperature of water one degree.)
Density of Gas:	3.214 grams per liter or 0.2006 pounds per cubic foot at normal temperature and pressure.
Specific Gravity of Gas:	(Air = 1.00 at 0° C.) 2.486 at 0° C. 2.481 at 20° C. 2.478 at 50° C. 2.469 at 100° C.

One volume of liquid chlorine at zero degrees C. yields theoretically 463.9 volumes of gas measured at normal temperature and pressure, or about 4,900,000 volumes of irritating air that will cause severe coughing and respiratory irritation. One pound of chlorine yields practically 5 cubic feet of gas measured at normal temperature and pressure.

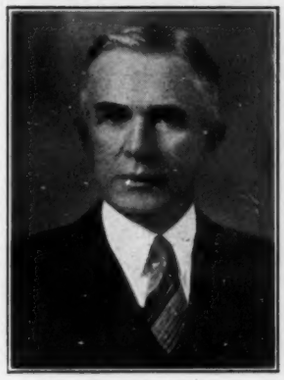
Flexibility of Chlorinator Service

Chlorine control machines are relatively expensive, yet ample reserve against extra demands or repairs is absolutely essential in every plant. To reduce the number of machines needed, and yet leave reliable reserve at the Richmond plant has been installed a most successful transfer system. There three points of chlorine application before filtration and four control machines are available on the transfer. By means of the transfer system, the opening of a valve permits any or all of the four chlorinators to supply any or all of the three points of application. By changing hose connections two additional control machines may be substituted thus making six machines almost immediately available at any point of chlorine application. Thus six machines give as reliable service as would ordinarily necessitate nine machines.

The author wishes to gratefully acknowledge his indebtedness for the suggestions and criticisms of: M. C. Smith, Chairman of the A. W. W. A. Committee on Chemical Hazards in Water Works; L. H. Enslow, Research Engineer of the Chlorine Institute, and Editor of WATER WORKS AND SEWERAGE, and to Carl Liepold of Winnetka, Ill.

Acknowledgment.—The above paper was presented before the 2nd Annual Convention of the Virginia Section of A. W. W. A. at Roanoke, Va., November 1935.

Robert B. Morse Dies Suddenly



Robert B. Morse

Robert Brooks Morse, Chief Engineer of the Washington (D. C.) Suburban Sanitary District, died on January 31st in a Washington hospital as the result of a streptococcus infection. He was 55 years old.

Mr. Morse was born in Baltimore, Md., the son of a distinguished father, who held the chair of Chemistry at Johns Hopkins University. He received his tuition in Johns Hopkins University, the University of Maine and Massachusetts Institute of Technology. After graduation he went with the Baltimore Sewerage Commission in 1905 and from 1910 to 1912 was an assistant engineer with the New York Metropolitan Sewerage Commission. Then he went to the Maryland State Department of Health to establish Divisions of Sanitary Engineering which gained for itself a distinctive reputation. Between the years 1912 and 1922 he served as Chief Engineer of the Maryland Department of Health, from which position he was selected to become Chief Engineer of the Washington Suburban Sanitary District, which he had been instrumental in organizing. Under his guidance the Washington Suburban Sanitary District, embracing 104 square miles of area surrounding the District of Columbia, became widely known for certain innovations and developments in financing, as well as for its technical works and organization. Amongst the innovations in technical works, the most widely known is the unique and attractive filtration plant of his design at Burnt Mills, Md., which is comprised of concentrically constructed steel tanks within steel tanks. This plant won for its designer a prize in 1935.

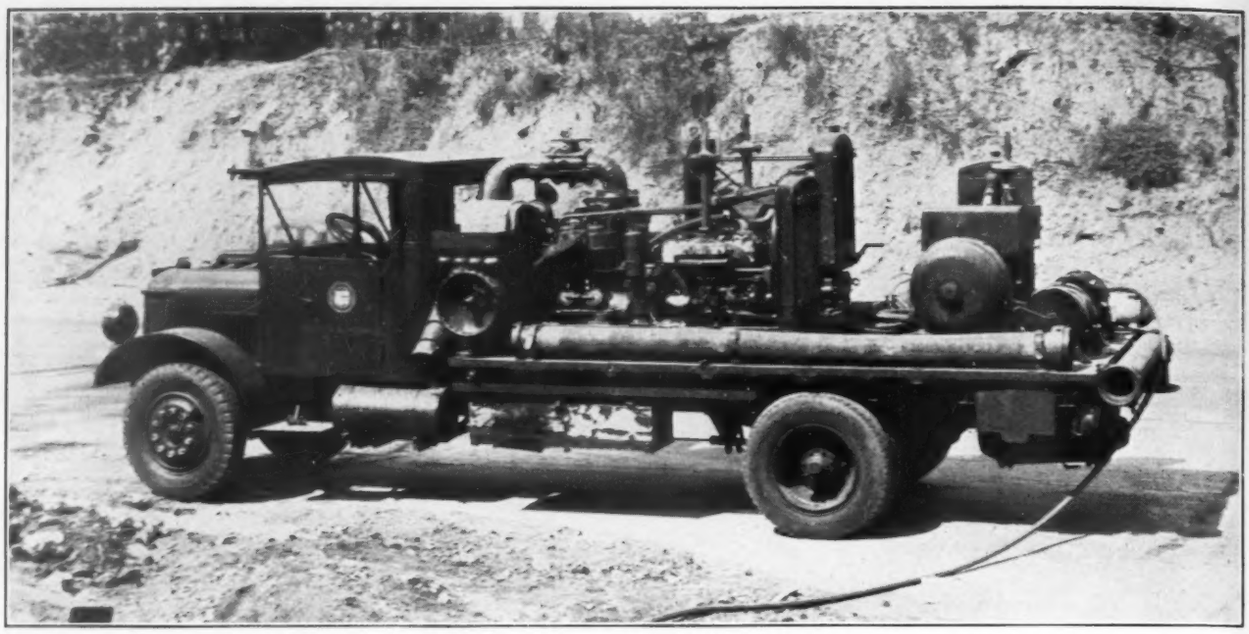
Mr. Morse was a member of the American Society of Civil Engineers, the American Water Works Association, New England Water Works Association, the American Society of Municipal Engineers and the American Public Health Association. He was a member of several clubs and Phi Beta Kappa Fraternity.

He was buried from his former home in Hyattsville, Md., on February 3rd and leaves a widow, a daughter and granddaughter. His close associate and principal assistant, Harry H. Hall, will carry on the work of his admired and capable chief.

▼

Milwaukee Gets Reprieve In Activated Sludge Case

The Chicago Circuit Court of Appeals has modified an earlier order that the whole of the income from sales of "Milorganite" (sludge fertilizer) from the Milwaukee Activated Sludge Plant be impounded to pay royalties on the activated sludge patents infringed by the Milwaukee Sewerage Commission in operating its plant. The Court's new order is that, henceforth, only 15 per cent of the income from fertilizer sales need be impounded because that amount is sufficient to meet royalties for which Activated Sludge, Inc., has been suing. To date, approximately $300,000 has accumulated in the impounded fund to satisfy the judgment.



Special Mobile Service Equipment Assembled in the Los Angeles Shops

It Contains a Gas Engine Driven Compressor of 110 Cu. Ft. Per Minute Capacity; a Fully Automatic 5 KW (110 Volt) Generator Set; a Centrifugal Pump (8 In. Self Priming) of 1,200 G.P.M. Capacity at 25 Ft. Suction Lift. Suction Hose, Air Hose, Light and Power Cables Fill in the Odd Spaces on the Truck

PRACTICAL PROBLEMS IN WATER DISTRIBUTION

By E. W. BREITKREUTZ*

Los Angeles, Calif.

IN discussing problems in water distribution the writer will confine himself to some of the experiences in the Los Angeles Water Bureau during the past twenty-two years.

An example of how a problem had to be solved in the days when such a thing as a Sanitary Engineering Division was unknown in the Water Bureau, is the following. A leak crew was called upon to determine the origin of a certain leak. There was some question as to its source, it possibly being from a broken sewer. The foreman in charge of the crew didn't waste much time debating the question; he scooped up a handful of the water, tasted it, and remarked, "It's not from a sewer."

For the most part those men in charge of the construction maintenance, and operation of the Los Angeles water distribution system of 3,828 miles of pipe and appurtenant valves, fire hydrants, et cetera, are a serious minded group. The mention of personnel brings to the fore a problem caused by the lay-off of employes during the present depression. The lay-off was conducted according to seniority. The younger men were let out first, leaving very few "come-along" men to take the places which will, from time to time, be made vacant by the loss of older men. Seniority must be followed in laying off civil service men, but it certainly is advisable to follow the rule of the "survival of the fittest" in the case of unclassified labor.

*Assistant Engineer, Pipe Construction Division.

Gate Valves

Valves—shut-off, regulating, altitude, relief, check, and float valves are a very vital part of the distribution system. In the Los Angeles distribution system, exclusive of San Fernando Valley, there are in operation about 40,000 shut-off valves, or "gates," as they are known. These are of approximately thirty different makes. Stocking of repair parts for such a group of gates is a problem in itself. About five hundred stems, consisting usually of one sample and two spares, must be kept on hand in an emergency tool room accessible at all hours to the proper employes.

Shut-off valves are usually kept in the open position in the distribution system. In the case of bronze mounted double-disc iron valves, corrosive waters cause a build up between the discs in the open position, sometimes making the valve inoperative. Under ordinary domestic pressure, brass trimmed, solid wedge valves operate satisfactorily for all sizes below 12-in. In our experience, all larger valves should have solid bronze discs, with other moving parts also made of the same material.

There are occasions when it is desirable to cut down the flow in certain mains; this has been done by partly closing a gate in the line. Gate discs projecting into the stream set up vibrations that are sometimes annoying to consumers and if left in the stream long enough, these vibrations may cause wear sufficient to cause the gate to drop off from the stem and do considerable

Full Pressure Tests on Valves. This One a 24-In. Horizontal Valve Under 175 Lb. Main Pressure

damage by water hammer or by hampering fire protection service. The solution is to arrange a battery of valves in various sizes so that complete closures of one or more would give the desired results.

Valves when used as dividing gates between districts of different elevation result in objectionable dead ends. These gates are frequently "cracked" to permit enough circulation to overcome this objection, but the consequent high velocity will cut the discs and seats so that a tight shut-off cannot be made when occasion demands. Where the pressure on the high side of the dividing gate is from gravity supplied water, a good procedure is to install a by-pass line around the gate, using a ½ inch copper service tubing and placing the stop-cock in a 6-inch gate well. If the high pressure side of the dividing gate is subject to pumping pressure, then the by-pass flow should be controlled by an orifice in a blind union, the orifice being amply protected by a strainer.

An annoying problem is the leaking of gates at the stuffing box after they have been operated for a shut-off. Gate-stem packing dries out and shrinks with age, and old tallow destroys the flax. A good flax oil impregnated packing that remains resilient will overcome this difficulty. Leaky packing can be replaced without tearing up pavement and removing the gate well if the stuffing box bolts are within hand reach from the street surface. This repacking requires the use of a puller for removing the gate key nut from the stem, and operations are greatly faciliated if the stuffing box bolts and nuts are of bronze and the operator has nimble fingers.

Keeping valves in good working order at all times is a problem requiring eternal vigilance. How often should valves be inspected and operated? In the case of trunk lines, all valves (main-line, lateral, and blow-off) should be operated at least once every six months and inspected every ninety days. Other valves in the gridiron system should be operated annually and inspected semi-annually. During the regular semi-annual operation, trunk line valves are closed to a point where they begin to whistle. All others are completely closed except dividing and blow-off gates which are operated only a few turns. During the operation rounds, stand pipes, gate-caps, manholes and covers, gears, leaky stuffing boxes, etcetera, get a thorough going over. On the inspection rounds, trunk line valves are closed about one-third and others are given a few turns. In addition to the regular inspection and operation, all valves are inspected whenever streets are resurfaced or improved by contract. In preparing for shut offs for connections, etcetera, valves should be gone over several days in advance.

Altitude and Pressure Regulating Valves

Altitude valves controlling the water level of tanks or reservoirs will sometimes give trouble in case of sudden peak demand when the valve is closed at the high water position. The sudden demand may create a vacuum on the low side and the valve fail to open. This may be avoided by by-passing the altitude valve with a line containing a check valve.

Pressure regulating valves are installed singly or in pairs, and are also arranged in graduated sizes. A large single regulator out of order can cause a lot of trouble but the chances of more than one of a pair or a battery going out of order at the same time is remote. Of course, there should be a thru connection with valve on the main line to facilitate repairs. Needle and pilot valves clog up if not properly protected by strainers. If the differential pressure is high, noises and vibrations may be avoided by reconstructing the piston with a perforated or saw-tooth skirt. Right angle connections when there are high velocities, are the cause of some of the noises and vibrations. These noises and vibrations may be reduced by blocking the vibrating sections to the reinforced roof of the vault. Residual stresses due to welded and flanged connections can be eliminated by the use of at least one lead joint in each branch of a regulator layout.

Every system supplied thru regulators should at all times be adequately connected to a reservoir controlled by an overflow. Or, if the system is closed, a relief valve of proper size must be installed. A well lighted regulator pit equipped with an automatic sump pump greatly facilitates repairs and inspection.

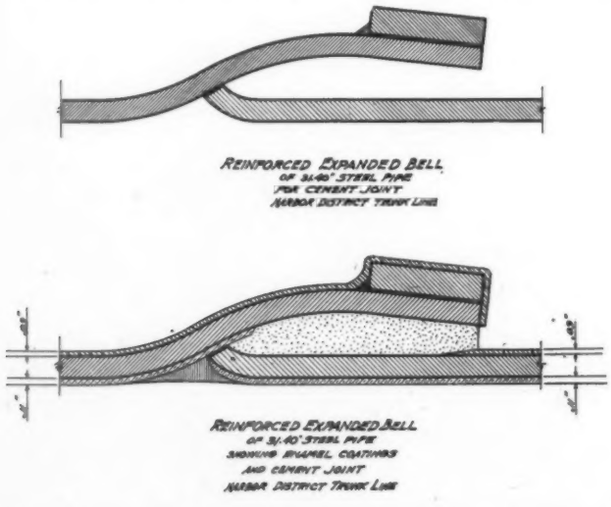
The secret of the success of regulating and altitude valves is constant watchfulness, and one of the best helps toward this end is the use of a seven day pressure recording gauge. These gauges, with dual pens, installed at each important valve, make weekly inspections mandatory because the recording charts must be changed and the clocks must be wound regularly. The charts tell the whole story of what takes place on either side of regulating or altitude valves, and reveal the existence of inoperative relief valves, water hammer, excessive demands, main failures, et cetera. Also, they show low consumption from tanks which float on the main, thus indicating when manual operation is necessary to keep the contents fresh. Of course, the ideal condition would be to have the superintendent's office equipped with remote controlled recording gauges connected to the various important points in the distribution system.

Some of the Results of Corrosion on Iron Gate Valve Discs—The Cause of Sticking Valves and Troubles

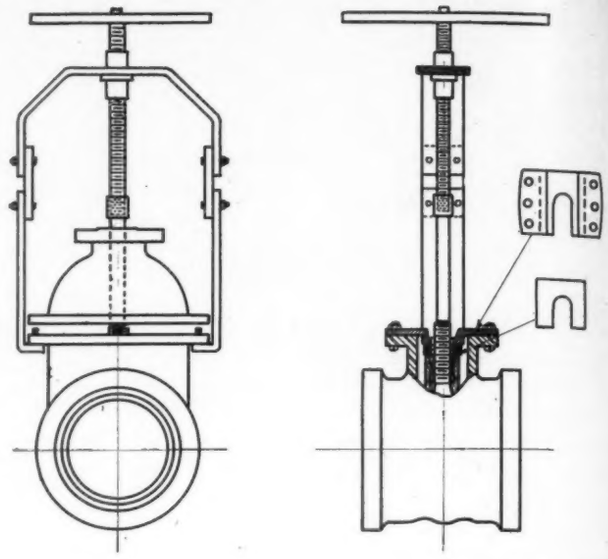
Main Interferences

One of the most perplexing problems that confronts the Water Works Superintendent is the interference of utility and public works substructures. It would seem that water, without which the existence of the human race would be a matter of hours, should have some preference as to substructure location in the public streets. However, such is not the case in Los Angeles where water mains sometimes take what is left—a location that would make a gopher dizzy to follow. All substructures constructed under the jurisdiction of the city, county, or state take preference over existing water mains, which must be relocated at the Department's expense. Private utilities are given permits to install structures in the streets without apparently any consideration as to possible damage to existing water lines or interference with location of future lines. Consequently, concrete structures have been built in direct contact with, and sometimes encasing, cast iron mains. Every such contact is a potential break. It would seem that in a semi-arid region, such as we have in the Southwest, more consideration would be given to the safety and reliability of our water distribution systems. For contrast, Milwaukee, with an unlimited supply of water close at hand, allows no one to excavate in a public street without first securing the permission of the Water Department. In the city of New York, inspectors appointed by the city and paid by the utilities, see that all municipal structures are protected during construction of any such private utility. Other substructures installed parallel to water mains should leave sufficient clearance for future service, fire hydrant, and main connections. Cross-overs should leave sufficient clearance for possible settlement of either substructure or water main. In the case of small mains, allowance should be made for future enlargement. In one instance an important 24-inch cast iron water main has been so hemmed in by the installation of parallel telephone conduits, (in some places three of them) that it is quite a problem to tap the water main. Some years ago the city proposed changing the grade of a portion of this street. If this proposal had been carried out, the Water Bureau would have had to relocate the 24-inch pipe in order to excavate to the proper grade instead of lowering it in the usual manner. It is becoming exceedingly difficult to secure locations that will conform to the original practice of uniformly installing mains on a selected side of the street and at a uniform distance from the curb.

All excavations in the public streets, in a measure, create potential hazards to the distribution system. Protective coatings on steel pipe are damaged; blocking at fittings and fire hydrants may be weakened; and supporting ground is sometimes removed for a considerable distance under cast iron mains. Contractors sometimes will excavate for a sewer, storm drain, or other structure closely parallel to and below water mains without notifying the Water Bureau. The fact that these things are permitted requires constant vigilance on the part of water works employees.



Details of Steel Pipe Jointing and Protective Coating



Device for Replacing Broken Valve Stems, Los Angeles Water Bureau. The Yoke Holds the Disc in Place While Removing Bonnet and Replacing Stem Under Full Main Pressure

The Value of Flexible Joints and Short Fittings

Bridges and grade separation structures are each an individual problem. Generally, there are fills to be crossed from solid ground to a rigid structure. Usually the fills are made near the completion of a job and with the public clamoring to open the street to traffic, they are improperly made with a consequent settling. Lead joints will leak and may increase the settlement, especially if it is a dry fill. Steel pipe with a rubber packed coupling seems to be the most satisfactory. Sand used as a backfill will usually keep the entire load of the pavement off the pipe because the sand will run under the pipe during settlement.

In 1919 the writer spent the greater part of a year in working on the design of a uniform standard of cast iron fittings for the Water Bureau. These fittings are known as the Los Angeles or "short-pattern," and they compare favorably with A. W. W. A. long pattern as to friction losses at ordinary distribution velocities. The short pattern fittings have several advantages over the long pattern, the lighter weight being cheaper, easier, to handle for installation, and requiring smaller excavation. They are designed for Class "C" pressure with Class "C" bells, and spigots dimensioned to fit Class "B" pipe. There are two types of fittings that are quite handy. One is an offset in various sizes that is very convenient in ducking over or under interfering substructures. The other fitting is a double-bell sleeve used in making final connections. It slips over the cast iron pipe, keeps the two ends in line, and still has a shoulder to retain the yarn.

Fire Hydrants

Fire hydrants used to be a source of considerable trouble for maintenance men. Valves worked loose because of operation and caused chattering, and the rubber in the valves would sometimes form a lip that caused severe water hammer when the hydrant was operated. The use of canvas-inserted rubber in the valves has alleviated the latter trouble and a hydrant designed and patented by one of our mechanics has taken care of the chattering valve problem and made possible quick field repairs to stems, seats, and valves. The greatest trouble with fire hydrants at present is the indiscriminate use of Stilson wrenches by unauthorized persons and the habit automobiles sometimes have of leaving the traveled road and seeking out innocent fire plugs.

Two Main System

Double mains avoid a good deal of pavement cutting for services installed after a street has been paved, cut down the number of consumers out of water during a shut-off, and increase fire protection. The number of valves required to properly gate a double main system, however, is usually more than twice that of single mains and the system is considerably more complicated to operate. It can readily be seen that there can be quite a variation in arrangement of connections and valves at street intersections. Usually, when a main is inadequate for service in a business or industrial district, a larger main is installed on the opposite side of the street and the old main is left in service. However, it sometimes happens that the old main is in the only location available for a larger main and thereby a real difficulty is presented.

The Water Bureau usually gets the blame for all water appearing on the streets, in basements, and in utility conduits. Some years ago the writer was handed a map by an engineer, in charge of a power conduit system, showing certain manholes and vaults that were partly filled with water and would refill when pumped dry. The intimation was that the water came from leaks in water pipes. It seems that the Water Bureau was expected to find the source of the water and stand the expense even though it proved of foreign origin. A regular search was made for leaks in the neighborhood of the manholes and vaults but without success. The power people were then told that they might go ahead and look for the origin of the water and that the Water Bureau would stand the expense if any of the water was proved to be coming from the water system. That was the last ever heard about water in those particular structures.

The writer has purposely omitted mentioning record control of the distribution system, and the merits of enamel protected steel pipe with either field welded or cement joints, as these two subjects cover a wide field and are to be separately treated at a future time.*

Acknowledgment.—The above paper was presented before the California Section of A. W. W. A. at San Diego, Calif., Oct. 24, 1935.

*Note—The author of this paper is scheduled to present a paper on "Record Control of a Distribution System" before the Los Angeles Convention of A. W. W. A., June 8-12.—Ed.

Legislative News Service to Be Featured by New Jersey Section

The New Jersey Section, American Water Works Association's youngest, held its second meeting in Trenton, N. J., on the afternoon and evening of January 29th. The meeting although a short one, as many of the meetings of this section will be due to its small geographical area, definitely assumed a high standard among water works gatherings. The attendance of 150, on a hard winter day, exceeded expectations.

The meeting opened with a Trustees' Luncheon in which a number of the members of the section participated. The afternoon session was devoted to a symposium on ground waters with especial reference to the well water supplies of the state. Papers were presented by Meredith Johnson, Assistant Geologist of the State of New Jersey, and Henry Barksdale of the State Water Policy Commission. Mr. Johnson outlined the geological features of the state with remarkable clarity, bringing out their relationships to the ground water conditions. Mr. Barksdale then followed with an exposition of the work which has been done by his department, in cooperation with the U. S. Geological Survey, in the making of intensive quantitative investigations of ground water conditions in several important areas of the state. These two interlocking papers produced a comprehensive and accurate picture of this important phase of New Jersey water supply engineering. Both papers were accompanied by numerous well chosen lantern slides.

Discussion on the same subject was presented by Roswell M. Roper, Manager of the East Orange, N. J., Water Department; William W. Brush, Editor of "Water Works Engineering"; J. A. Carr, Superintendent of the Ridgewood, N. J., Water Department; D. H. Townley, Engineer of the Elizabethtown Water Company of Elizabethtown, N. J.; M. B. Frost, Engineer of the New Jersey Water Company of Haddon Heights, N. J.; J. N. Brooks of the State Water Policy Commission and Dr. Henry B. Kummel, former New Jersey State Geologist.

Features of the meeting were the introduction of new members who have joined the section since its formation last fall, and the announcement by P. S. Wilson, Secy. of the Section, of plans of the section to render a "legislative news service" to its members. This latter feature is designed to keep the members fully posted and up to the minute on legislative developments in New Jersey which have any bearing on or relate to water works, sewerage and engineering matters. Several questions of state-wide importance which are now pending before the New Jersey legislature should make this service of particular interest and value to members.

At the dinner, which followed this program, the speaker of the evening was Dr. J. G. Lipman, Dean of the College of Agriculture and Director of the State Experiment Station at Rutgers University. Dean Lipman, an after dinner speaker of note, told of the effects of surface run-off upon soils and vegetation; with particular reference to the problems of soil erosion. The remainder of the evening was devoted to entertainment contributed by the Chairman of A. W. W. A.'s Entertainment Committee, "Bill" Orchard, assisted by his renowned "trained singing seals." The high class of this musical program was maintained by Miss Betty Newkirk, who performed with a deal of talent on the violin and on the oboe. Miss Betty, incidentally, is the daughter of S. F. Newkirk, Sr., Chairman of the New Jersey Section. And if he brings up his "baby section" as he has his baby daughter, hats off to "Daddy" Newkirk.

GENERAL CONDITIONS THAT AFFECT PROFITS IN WATER WORKS OPERATION

By CHARLES H. CAPEN, JR.

VOLUMINOUS data are available regarding the cost of supplying water and the profit to be obtained therefrom. Frequently when such a subject is discussed, the items most considered are the cost of pumping, purification, transmission and distribution. In other words, the tangible and self evident features naturally come to mind first and may be regarded as all important. In articles which have appeared in previous issues of WATER WORKS AND SEWERAGE [1], [2], the writer pointed out the relationships of some of these items to the cost of doing business, as well as the general financial risk involved in water works operation.

Passing from the details of an individual water supply system, the path leads naturally to the subject of inter-relationship of various supplies to the probability of making profits. In attempting to correlate some of these factors, a number of supplies have been studied with respect to total operating costs, volume of business, total investment and geographical location, each factor in turn having been considered in relation to profits obtained from operation.

Supplies Used as a Yardstick

Since previous studies have shown that municipal supplies are frequently subject to influences that might distort the ultimate picture beyond recognition, the present study was limited to privately owned water utilities. Those in New Jersey were chosen because of familiarity with them. After some study, the year 1928 was selected as typical of an era of prosperity and 1932 as typical of the depression period.

For these years there were listed all the water companies having a gross income of more than $10,000 per year and reporting to the Public Utility Commission for both years. Companies acting entirely or largely as agencies for transporting water were eliminated, as was also one other company which for specific reasons was not typical. This left twenty-five supplies, scattered throughout the state, statistics for which were obtained and analyzed by several methods in order to secure representative companies.

Basis of Comparison

From reports to the Public Utility Commission for each of the twenty-five companies for the years 1928 and 1932, figures covering fixed capital, total revenue, operating cost, net income and million gallons output were taken. Then the rates (expressed as a per cent) of total revenue to fixed capital; net income to fixed capital, and net income to total revenue were computed. Also the operating cost per million gallons was computed. The operating cost included normal operating expenditures plus taxes, amortization and interest on bonded indebtedness. It represented the difference between gross revenue and net income and including dividends on stock and additions to surplus.

After some study it was found that the companies could be conveniently arranged in groups of five. While some rather wide variations occurred in some of the groups of five, the general trend was often quite obvious as will be shown by referring to the accompanying tables.

In Table 1 appear the results of the arrangement of the five groups into the order of operating cost per million gallons for both 1928 and 1932. Also there is shown a special arrangement of the 1932 results based on the order of operating costs in 1928. This latter is a somewhat logical departure from the ordinary because of special conditions created by the depression. For the year 1928 the results show very definitely that as the operating cost per million gallons goes up, the three ratios presented go down. This is to be expected and indicates that companies doing business at a low rate of cost require a larger per cent margin of profit to allow for contingencies. In the year 1928 the trend is particularly uniform, but some deviations exist in both of the 1932 columns. In almost every case where a deviation does occur, investigation has shown that one company of the group of five had an abnormal figure for some specific local reason. With these few exceptions eliminated the trend is even more unmistakable.

Table 2 discloses the relation of volume of output (in million gallons) to the other factors. This table indicates that there is no uniform relation between volume of sales and revenue or profits; but, in general, the

TABLE 1—AVERAGE OPERATING COSTS FOR 1928 AND 1932 AND THEIR RELATION TO REVENUE AND NET INCOME

	Group				
Operating Cost Per M. G.:	1	2	3	4	5
1928	$ 81	$145	$177	$229	$366
1932 in same order as 1928	105	182	224	243	372
1932 in numerical sequence	105	181	218	250	372
Ratio Revenue to Capital:					
1928	16.5	16.6	15.6	14.8	11.6
1932 (order of 1928)	15.0	15.2	12.2	14.2	10.9
1932 (order of 1932)	15.0	15.0	12.8	13.7	10.9
Ratio Net Income to Capital:					
1928	6.30	5.80	4.14	2.64	2.35
1932 (order of 1928)	4.84	4.30	2.98	2.77	2.18
1932 (order of 1932)	4.84	4.27	2.01	3.18	2.18
Ratio Net Income to Revenue:					
1928	38.6	30.8	22.7	17.5	21.1
1932 (order of 1928)	30.9	27.0	24.9	19.1	19.8
1932 (order of 1932)	30.9	31.1	15.9	23.9	19.8

Note: All ratios expressed as a per cent.

TABLE 2—AVERAGE OUTPUT FOR 1928 AND ITS RELATION TO REVENUE, NET INCOME AND COST

Output M. G. D.	0.20	0.40	0.75	3.10	14.20
	Group				
	1	2	3	4	5
Output M. G. D.	0.20	0.40	0.75	3.10	14.20
Ratio revenue to capital*	12.4	15.9	16.2	13.7	17.0
Ratio net income to capital*	3.96	3.85	4.75	3.86	4.80
Ratio net income to revenue*	31.8	23.4	30.2	25.7	27.3
Operating cost per M. G.	$240	$213	$263	$118	$169

*Note: All ratios expressed as a per cent.

TABLE 3—AVERAGE FIXED CAPITAL FOR 1928 AND ITS RELATION TO REVENUE AND NET INCOME

	Group 1	Group 2	Group 3	Group 4	Group 5
Fixed capital	$146,000	$228,000	$460,000	$1,558,000	$8,568,000
Ratio revenue to capital*	15.2	13.5	18.1	13.7	14.5
Ratio net income to capital*	5.87	2.78	5.82	3.92	4.07
Ratio net income to revenue*	38.7	22.1	32.9	19.1	25.7

*Note: All ratios expressed as a per cent.

TABLE 4—GEOGRAPHICAL LOCATION AND ITS RELATION TO AVERAGE REVENUE, NET INCOME, OPERATING COST AND FIXED CAPITAL FOR 1928 AND 1932

	Group 1 Five in N. E. Section	Group 2 Five in N. W. Section	Group 3 Five in Central Section	Group 4 Six in S. W. Section	Group 5 Four in S. E. Section
Ratio of revenue to capital:*					
1928	17.0	15.5	16.7	13.8	11.8
1932	15.4	13.1	13.2	13.9	11.4
Ratio net income to capital:*					
1928	4.80	5.37	5.40	2.19	3.77
1932	4.70	3.61	3.08	2.86	3.06
Ratio net income to revenue:*					
1928	27.3	34.0	33.7	15.7	30.9
1932	27.9	24.9	25.1	19.8	25.0
Operating cost per M. G.:					
1928	$169	$147	$145	$276	$257
1932	223	180	186	268	292
Water output M. G. D.:					
1928	14.2	0.81	0.82	1.03	1.77
1932	12.7	0.58	0.79	1.12	1.75
Per cent loss or gain in output	—10.3	—28.5	—0.4	+9.7	—1.0
Fixed capital:					
1928	$8,519,000	$245,000	$325,000	$688,000	$2,056,000
1932	9,937,000	291,000	462,000	786,000	2,491,000
Per cent increase in capital	16.7	18.7	42.1	14.2	21.2

*Note: All ratios expressed as a per cent.

TABLE 5—SUMMARY OF STATISTICS FOR 25 COMPANIES FOR 1928 AND 1932

Average	1928	1932	Per cent Change
Fixed capital	$2,312,000	$2,725,000	
Total revenue	316,000	354,000	+17.8
Net income	74,000	87,000	+17.6
Operating cost	242,000	267.000	+10.3
Output—M. G. D.	3.71	3.28	— 8.9
Ratio revenue to capital:*			
Arithmetic	15.0	13.5	—10.0
Weighted	13.6	13.0	— 4.4
Ratio net income to capital:*			
Arithmetic	4.24	3.41	—19.6
Weighted	3.22	3.21	— 0.3
Ratio net income to revenue:*			
Arithmetic	27.7	24.3	—12.3
Weighted	23.5	24.7	+ 5.1
Operating cost per M. G.:			
Arithmetic	$200	$225	+12.5
Weighted	178	215	+20.7

*Note: All ratios expressed as a per cent.

larger companies can operate at a lower unit cost than the smaller ones. Nevertheless, the writer has previously demonstrated (2) that very small companies, i.e., those having less than $10,000 per year gross revenue, have a precarious existence and usually have low ratios of net income to revenue.

Table 3 shows the relation of fixed capital to the other factors, a somewhat conglomerate comparison for the reason that some of the ratios are based on the fixed capital. Since volume of output is somewhat in proportion to capital invested, it can easily be expected that this table would, like the preceding one, show little or no general trend and such is exactly the case.

In arranging the supplies by geographical location it was found that there were three groups of five each, one of six and one of four. The results are shown in Table 4. The outstanding point of significance in this table is that the large companies in the densely populated northeastern section of the state, which have always enjoyed good management, have suffered far less during the depression than the smaller companies elsewhere. This is particularly noteworthy because of the fact that the larger industrial areas in the northeastern section have shown a generally greater decrease in water consumption than all but one of the other groups. This northeastern group coincides with the Group 5 of Table 2, being the five largest private supplies in the state.

The northwestern section, Group 2 of Table 4, is composed of supplies located in small municipalities having mainly one or two large industries and their output and profits have suffered accordingly. Strangely enough, the central New Jersey group, which has not suffered noticeably in volume of output, has been affected most in the matter of income and profits. The explanation for this appears to be in the very large increase in fixed capital made by three of these companies between 1928 and 1932, with corresponding increases in fixed obligations but without simultaneous increases in revenues.

For the purpose of comparing individual groups with the whole, Table 5 has been prepared. It is more or less self-explanatory and no prolonged discussion of it need be given. Its significant features are the following:

Average revenue has increased during the four year period.

Average net income has increased in spite of increased operating costs and decreased output. This speaks well for economies introduced by the companies, even though the arithmetic average ratio of net income to revenue has decreased.

Some of these factors, regarding these same companies, were discussed in a very instructive way by Kilpatrick[3]. On close scrutiny it may be found, however, that he apparently lacked personal contact and knowledge of the supplies that would have permitted elimination of some cases which for various reasons detract from the force of any conclusions that might be drawn.

Conclusions

As a result of these studies it may be concluded that:

1. Water systems operating at a low cost require a greater ratio of revenue to fixed capital, net income to fixed capital and net income to revenue, than to those operating at higher costs.
2. Volume of output has no marked relation to the revenue and net income ratios but tends toward an inverse relation to operating cost.
3. Fixed capital is somewhat proportional to volume of output and has the same general irregularities.
4. Geographical location has little effect on any of the ratios except insofar as it may in turn be subject to wide variations in volume of output.
5. Total revenue has increased 17.8 per cent while output has gone down 8.9 per cent, a truly remarkable showing which has been caused mainly by rate increases and by absorption of two or three small, well operated supplies by larger ones.

In all fairness, it must be stated that while the larger companies continued to enjoy substantially the same profits in 1933 as in 1932, some of the smaller ones did not. In the latter part of 1933 there was an upturn in water consumption but even so the average for the year was lower than in 1932.

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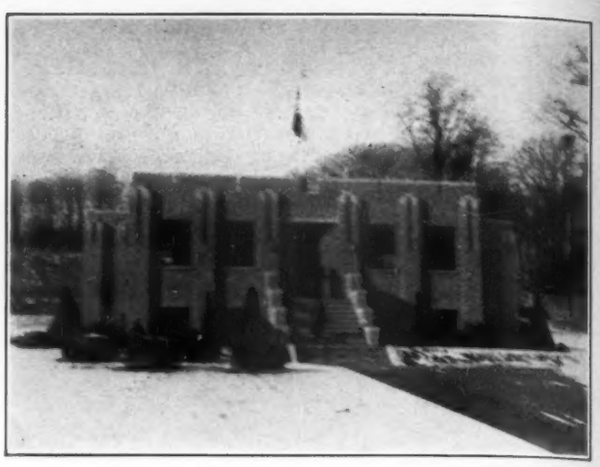


The New Mechanical Sewage Treatment Plant of Great Neck, L. I.

MEETING OF THE N. Y. S. S. W. A.

THE New York State Sewage Works Association held its 8th Annual Meeting at Hotel Astor in New York City on January 15th—the registered attendance being 200, with a total of 225 or more attending.

On the evening previous (January 14th) was held the Annual Joint Dinner of the Sanitary Engineering Section of the American Society of Civil Engineers and N. Y. S. S. W. A.—at which the high-light of the evening was the principal address by Abel Wolman, speaking as Chairman of the National Committee on Water Resources. Mr. Wolman pointed to the fact that, by actual survey, it had been revealed that stream cleansing (sewage and waste treatment) had been little or no better in those states having strong anti-pollution laws than in those with none. Actual accomplishments in stream cleansing had been ridiculously small in the 6 states responsible for the greatest pollution. And, even more impressive was the disclosure that of the sewage discharged by the 95 major cities in the United States not more than 15 per cent of the sewage from that group received any degree of treatment beyond screening or sedimentation. To correct such a situation, Mr. Wolman reviewed the several plans now under consideration and evaluation by the National Water Resources Committee and other agencies cooperating. The thought of a uniform law aimed at the correction of industrial waste treatment had been evaluated as being basically fallacious and unsupportable. Joint compacts, by two or more states, had not proved workable in the past and had questionable value as a practicable method. Uniform concurrent state laws held more promise, but the scheme of assisting industry and municipalities by "Grant and Aid" procedure in some form through the Federal Government held the most promise as a measure working toward the advancing of stream cleansing in the shortest time and with the least friction. It was apparent that some form of regional-planning under a Federal authority, qualified to over-ride state boundaries, was a necessity. Such an authority should be, in his (Wolman's) opinion, limited to investigation, the making of studies and broad planning. The design, administration and execution should be confined to state authorities and private enterprise, assisted by Federal funds and support where needed.

Linn H. Enslow, President of the Association

Morris M. Cohn, Retiring President

Kenneth Allen Award to Hendon and Zack

To Harry H. Hendon, Sanitary Engineer, Birmingham, Ala., was presented the Kenneth Allen Memorial Award in recognition of his "advanced thinking and research and his contribution to the advancement of chemical treatment of sewage." Before the association in 1935, Mr. Hendon presented a paper describing "The Shades Valley Chemical Precipitation Plant at Birmingham, Ala."* A second paper, dealing with operating results during the past year, was presented by Mr. Hendon during this meeting. An abstract of it appears later in this report.

To S. I. Zack, Sanitary Engineer, Filtration Equipment Corporation, New York City, went the parallel Kenneth Allen Memorial Award for his "contribution to the advancement of the science of and knowledge concerning sewage treatment." More specifically the award was voted for his paper—"The Settling and Filtering of Activated Sludge Effluents at the Chicago North-Side Plant" which was printed in the May, 1935, issue of *Sewage Works Journal.* (In digest form Mr. Zack's paper appears in WATER WORKS & SEWERAGE for July, 1935—see pages 247 and 248.

An annual award has also been established by the Plant Rating Committee of the Association for plant operators. It will be presented to that operator submitting the best plant operating reports during the year. The prize, to be retained by the winner, is a large loving-cup suitably engraved to show the name of plant and operator.

*Mr. Hendon's paper was printed in full in the March, 1935, issue of WATER WORKS & SEWERAGE.—Ed.

Chas. C. Agar, Retiring Chairman of Program Committee and Wheel-Horse of the Association, Elected Vice President

"Bill" Raisch, Chairman, Committee on Local Arrangements. (He's re-elected.)

Commissioner Binger Luncheon Speaker

During the luncheon, attended by 175, Engineering Commissioner Walter D. Binger, of the New York Department of Sanitation, spoke on "Developments and Planning in the Treatment of Sewage by New York City," in which he told of the immediate effects noted when the new 35 M.G.D. Coney Island Plant (a seasonal chemical treatment plant completed in a record time of 122 days after awarding contracts), had been placed in operation in the Summer of 1935. The 180 M.G.D. Wards Island Activated Sludge Plant was expected to be ready for operation in 1937 and design was well under way for the 40 M.G.D. Talman's Island Activated Sludge Plant. To design the 65 M.G.D. Jamaica Bay Plant, a force had been assembled and $80,000 for the purpose had been made available. Mr. Binger said that he could now say that New York City finally had a *real plan* under way and complimented the engineering staff, headed by Richard Gould, on its accomplishments.

Introduced at the luncheon was a guest from afar, Henry Hodgson of Adelaide, Australia, Sanitation Engineer of the South Australian Government, who is at present making a study of sewerage development in America.

Long Island Section Established

It was announced that the increasing size of the association had led the Executive Committee to approve the establishment of the Long Island Section of N. Y. S. S. W. A., whose organization had already been competed by L. L. Luther and Wellington Donaldson. This, the first section of the association, is an outgrowth of the Long Island Conference of Sewage Works Operators which has held frequent meetings during the past year. Henceforth it will be the policy of the parent association, which is now the largest sewage works association in the world (395 members), to encourage the establishment of regional sections to better serve the small plant operator. For the same reason the association offers a 33 per cent reduction in annual membership dues to "working operators"—viz.: to operators performing routine plant operation as distinguished from supervisor-operators or superintendents who take little or no part in manual operation.

That N. Y. S. S. W. A. is still growing was indicated by the 72 new members added in 1935 and 45 or more applications already received during January, 1936. The Spring meeting of the association to be held in June is expected to be an outstanding one. It will be held at the Lido Beach Club, near Freeport and Long Beach, L. I. Larry Luther, the Long Island "Go-Getter" is in charge of arrangements and promises to outdo the Schenectady meeting of 1935, which holds the records for sewage works association meetings.

New Officers

Officers elected for the ensuing year are:

President, Linn H. Enslow, Editor, WATER WORKS AND SEWERAGE, New York, N. Y.

Luncheon Session, 8th Annual Meeting of the New York State Sewage Works Assn., New York City, January 15, 1936. At the Speakers Table (Reading from Left): Richard Gould, Chas. Agar, Robt. Wheeler, Walter D. Binger (Guest Speaker), Morris Cohn, S. I. Zack, Linn Enslow, Harry Hendon, Arthur Bedell.

New Members of Executive Board
T. J. Smith, Chief Operator, Newark, N. Y.; Harry Eustance, City Engr., Ithica, N. Y.; Fred J. Biele, Consulting Engineer, Huntington, L. I.

Vice-Pres., Chas. C. Agar, Engr., State Dept. Health, Albany, N. Y.
Sec'y-Treas., Arthur S. Bedell, Engr., State Dept. Health, Albany, N. Y.
To the Executive Committee—
Harry Eustance, City Engr., Ithaca, N. Y.;
Thomas J. Smith, Supt., Sewage Treatment, Newark, N. Y.;
Fred. J. Biele, Cons. Engr., Huntington (L. I.), N. Y.

Great Neck Plant Inspected

The annual trip of inspection, taken by upwards of 175, was arranged by William Raisch, Chairman of the Committee on Local Arrangements, whose firm, Municipal Sanitary Service Corp., supplied the transportation by busses and also served a tasty buffet luncheon at the plant. This new and novel plant serving Great Neck, L. I., had been described earlier in a paper presented January 14th by John V. Fenton of Carman-Dunne, Inc., the designing engineers. It is briefed later in this report. The absolute absence of odors of sewage within the main building, housing the revolving drum filters (and in which luncheon was served), was especially noticeable. The process consists of pre-chlorination, sedimentation, addition of paper pulp and mechanical low-vacuum filtration, with return of the pulp for reuse. Following the treatment plant inspection, the architecturally attractive main pumping station, located in a high class residual section, was visited. On this trip were many members from the Sanitary Engineering Division of A. S. C. E., who had been extended a special invitation by N. Y. S. S. W. A. to take the trip as its guests.

Technical Sessions

(President, Morris M. Cohn, presiding)

The opening paper by Earl Devendorf, Associate Director, Division of Sanitation of the New York State Department of Health, constituted a review of "Progress in Sewerage in N. Y. State" in which he recounted the part played by Federal and State relief appropriations in securing sewerage betterments and new plants for the state. In presenting the record of accomplishments up to July, 1935, he showed that under PWA financing in 1933 there had been 33 new sewerage projects completed at a cost of $10,700,000; for 1935 PWA allocations for 25 new projects in New York State netted $48,000,000 —the largest single item being that to complete the Wards Island plant for New York City. TERA sewerage projects (1931-1933) had amounted to $11,000,000 and in (1934-1935) an additional $23,500,000. Under CWA had been spent $8,000,000 in 1933 and '34 on 321 projects of small size mostly. Under all agencies 273 miles of new sanitary sewers and 233 miles of storm sewers had been constructed in addition to the 48 new treatment plants.

Mr. Devendorf, who has been working with PWA authorities very closely, felt that the grant and aid procedure by the Federal Government was not to be discontinued. Instead, relief of unemployed would continue at a gradually reduced rate. In the meantime wide-awake municipalities were making plans and preparations *now* so as to be in readiness for the next Government offer of grants for public utility construction. The favored applicants in the past had been those who had plans in readiness to start work without delay.

"Progress in the Treatment of Milk Wastes" by DR. C. R. ROBERTS, Sheffield Farms, Inc., New York, N. Y.

In reviewing progress made during recent years in the treatment of wastes from milk and milk-products plants in general and, more specifically, recounting what had been accomplished by his own company, Dr. Roberts stressed the value of procedures looking to the reduction of wasted milk by better plant management and operation as the simplest and basically sound first step. The next was that of recovery of products (by products) from plant wastes which would pay at least some part, if not actually a profit, on the operations. The last and final step to be taken, and the most expensive step, was that of treatment of the residual waste. On these premises his company had considered it profitable to undertake by-product recovery research to reduce costs of pollution abatement.

By modernization of milk can dumping procedures the organic content of the waste (spilled and wasted milk) had been reduced by 50 per cent. That was common sense and money in pocket. By blowing out cooling coils before daily washing there had resulted a further reduction of unaccounted for milk and less pollution. For these paying procedures Sheffield Farms, Inc., had put $50,000 into plant improvements during 1935. In cheese production the wasted whey was the problem. Methods had been developed to remove the fat as whey-butter and additions of lime and boiling had produced calcium lactate and evaporation of the liquor on hot roll driers produced a poultry food. Casein whey was boiled with hydrochloric acid to precipitate high protein poultry feed. Research at Hobart, N. Y., showed promise in recovery processes which involved, principally, protein precipitation and evaporation to recover the carbohydrates. Although the lactose (milk-sugar) market was limited the production of sodium lactate looked promising as a glycerine substitute for automobile radiators and use in fabric printing. The chief difficulty in getting by-product production under way was the number and cost and smallness of the many plants required. The first of such plants was now under construction, however, at Norwich, N. Y.

Anthony J. Fischer (For His Paper on Sludge Disposal, We Nominate Him for the Kenneth Allen Award)

"Dick" Gould, Chief Engr., N. Y. Dept. of Sanitation. (His Boss Said Nice Things About Him— It's Mutual)

Good Operators—All Three
Hubert Becker, Jr., Supt. Dyckman Plant, New York City; Frank Klinck, Supt. Treatment, Lawrence, L. I.; Chester Proudman, Supt. Treatment, New Canan, Conn.

Concerning treatment of the wastes, the sprinkling filter process had proved the most dependable and least costly. The application of the waste to the filter while in a fresh condition was highly important—the permissible loading being 1 M.G./acre/day of wastes containing 1000 ppm. total solids. Intermittent pumping from a collecting sump to rotary distributor filters was being most generally employed. More recently the recirculation scheme of Dr. H. O. Halvorsen had been developed and looked to be markedly more efficient and economical. In this method much of the filter discharge was returned to the applied waste and by such high rate recirculation, assisted by forced filter ventilation, 20 to 30 M.G.D. could be treated daily on each acre of filter area. The promise held by this system was uppermost in the minds of the dairy products manufacturer because of the flexibility of operation and reduced capital investment it would effect.

Professor C. L. WALKER, Cornell University, stressed the importance of avoiding settling tanks or large collecting sumps ahead of sprinkling filters in order to preclude anaerobic conditions. Also, the desirability of applications to the filter at frequent intervals for shorter periods. Filters of 6 to 8 ft. depth had successfully handled 0.5 to 1.0 M.G.D. of waste. Where municipal sewer system was available he advocated partial treatment of milk wastes at the source, the effluent being discharged to the sewer.

L. I. HOLDREDGE, Dist. Engr., N. Y. State Department of Health, said that the acidity of milk wastes (pH 4 to 5) was highly inhibitory to the action of a sprinkling filter and lime addition would not improve conditions to any worth while extent. The loading of 5.5 lbs. of 5 day oxygen demand (B.O.D.) for each 100 cu. ft. of filter stone was a permissible average loading over a period of time. Some wastes could, therefore, be handled to the extent of 2 to 3 M.G./acre/day, depending upon their strength and filter depth. By the Halvorsen system of recirculation a waste with 4000 p.p.m. B.O.D. value applied at 20 to 30 M.G./acre/day had produced an effluent averaging 120 p.p.m. B.O.D. and pH 7.2.

DR. H. A. TREMBLER, Director of Research, National Dairy Products Laboratories, Baltimore, Md., was favorably impressed with the Halvorsen system. He also commented that iron salts would precipitate albumen and casein and, further, that with gentle air blowing the ferric precipitate present seemed to act catalytically in rapid oxidation of the residual lactose to carbon dioxide and water.

Chemical Treatment

"Chemical Treatment During 1935 at Birmingham, Ala., by H. H. HENDON, Sanitary Engineer, Jefferson, County and Birmingham, Ala.

In reporting on operating experiences at the new Shades Valley Chemical Treatment plant, described by him before the association a year ago (see WATER WORKS & SEWERAGE, March, 1935), Mr. Hendon said that the chief difficulty encountered had been the marked variations in flow and strength of sewage reaching the plant. The chemical consumption, however, had proved less than predicted from the experimental studies which had led to the design of the chemical plant. During the winter months of plain sedimentation and separate digestion, operating costs had varied from $11.30 to $12.25 per M.G. treated. The added average cost for chemicals (copperas @ $15.00 ton and chlorine at 3 cents per lb.) had been $5.10 per M.G., making the summer operation involving chemical treatment cost $17.10 per million.

Experiments with lime and sulphuric acid to secure a variety of pH values in search of the highest overall chemical economy had only proved that the highest economy on the Shades Valley sewage was had with nothing more than copperas and chlorine (chlorinated-copperas). This, because the savings in copperas and chlorine was not sufficient to pay for the acid or lime required—even when a pH reduction to 4.2 with acid had cut the copperas and chlorine required practically in half. Actually the net cost was twice as much when lime was used (pH 9) and four times as much when acid was employed (pH 4.2), not to mention the undesirability of additional chemical handling and control.

Concerning the parallel vs. series operation of the sedimentation tanks, Mr. Hendon said there was now reason to doubt that pre-sedimentation could be credited with the production of the chemical economy which he had earlier observed and reported in 1935. In other directions series operation of the settling tanks, during chemical treatment, and their parallel operation to care, for the maximum loadings the plant could handle, had distinct advantages. In chemical treatment there was a real and proven value in returning the chemical sludge from the precipitation tank to the crude sewage for consolidation of the two sludges in the primary tank. The absorption of odors by the iron sludge eliminated prechlorination and reduced the coagulant dosage required by the pre-settled sewage. Also quality variations in the crude sewage were smoothed out in the primary tank, thus simplifying chemical control. In the design it had been assumed that 1 hour theoretical detention in the chemical precipitation tank would be sufficient but operations had indicated that 1.5 to 2.0 hours

Proof That Sewage Never Hurt Anybody! Look at 'em! Larry Luther, Freeport, L. I.; Frank Hall, Mineola, L. I.

The Main Sewage Pumping Station of Great Neck, L. I., Attracts the Eye. Located on a Corner Lot in a High Class Residential Section Is Kept Spic and Span; Smells the Same Way

were necessary. Consequently, at flows exceeding 1.5 M.G.D. rates, parallel operation of tanks had been the order employed for best results. Fortunately the change over was a mere valve operation job.

In attempting sludge recirculation, to increase efficiencies, they had learned of the dangers of peptization of the iron sludge and reduction of the ferric iron unless aeration or sufficient chlorine were employed to preclude septization of the sludge and its bad effects. Such included black color of sewage, odors, and soluble ferrous iron in the effluent. As long as kept fresh, sludge recirculation, to maintain 20 per cent sludge by volume, produced maximum reduction of B.O.D., whereas 10 to 15 per cent maintained had produced maximum removal of non-settling suspended solids. Freshly settled chemical sludge contained 1 per cent solids which gradually thickened during the next fourteen hours in the clarifier to 2.5 per cent solids. But, on longer holding at summer temperatures the sludge would swell again and drop in solids content progressively.

In the reduction of suspended solids and B.O.D. it appeared that the first 10 per cent of the copperas required, to produce a well defined floc, removed one-half of the maximum non-settleable solids that were removable; and, a 50 per cent dosage removed 80 of the possible 100 per cent. The last 50 per cent of the clarifying dosage accounted for only 20 per cent of the total and represented the cost of producing an effluent with pleasing appearances.

Concerning the quality of supernatant liquor from the two stage digesters, the suspended solids content had averaged 204 p.p.m. and the B.O.D. value was unbelievably low at 64 p.p.m. The iron content (practically all in solution as ferrous iron) was 200 p.p.m. Upon chlorination it coagulated to produce a water white supernatant with a B.O.D. and suspended solids content of 10 p.p.m. (Looks interesting as a method of recovery of iron for re-use in coagulation.—Ed.)

In his conclusions, Mr. Hendon stated that the results from the Shades Valley plant had passed expectations at costs lower than any other process productive of a like purification. In addition the degree of purification and attendant costs were flexible. The use of copperas and chlorine unaided by acid or alkali had proved the most economical procedure and return of sludge to the crude sewage had proved its merits. For maximum sludge concentration, a transfer schedule to the digesters had been evolved to insure maximum concentration and therefore minimum volume of combined sludges to be handled.

"Operating Experiences at Perth Amboy, N. J." —By S. I. ZACK, San. Engr., Filtration Equipment Corporation, New York City, N. Y.

Reporting on operating results at the new chemical treatment plant at Perth Amboy, N. J., employing ferric chloride and lime (automatically controlled), air mixing and flocculation, effluent filtration through Laughlin magnetite up-flow filters, and vacuum sludge dewatering, Mr. Zack explained that the problem at Perth Amboy was primarily that of solids removal and only secondarily B.O.D. reduction. The major problem during the 60 day period of use of chemicals in 1935 had been chemical control to meet the marked variations in sewage quality (pH 2 to 9) created by industrial waste discharges. However, average removals of 90 per cent of suspended solids and 60 to 65 per cent of the oxygen demand had been secured—much of which could be attributed to the performance of the magnetite filter. Especially had this been the case during periods when flocculation was deficient and the filtration rate averaged 0.75 gal./sq. ft./min. During this 60 day period the chemical dosages had averaged 659 lbs. of lime and 252 lbs. of ferric chloride ($Fe\ Cl_3$) per million gallons. Suspended solids had been reduced from 240 to 28 p.p.m. and B.O.D. 242 to 86 p.p.m. in July and 271 to 116 p.p.m. in August.

During October, November and December, with a less septic sewage to which no chemicals had been added, were settling and up-flow filtration (rates from 0.76 to 0.93 gals./sq. ft./min.) and reduced suspended solids from 203 to 61 p.p.m. (70 per cent removal) and B.O.D. 249 to 173 p.p.m. (31 per cent removal). It was then discovered that sludge allowed to accumulate to a depth of 4 ft. in the clarifiers had been the cause of unexplainably low (31 per cent) reduction in B.O.D. as compared with the 70 per cent removal of suspended solids. This had not been appreciated during the period of chemical treatment and probably accounted for the low reduction of B.O.D.—viz.: 60 per cent average for July and August. By keeping the sludge depth to less than 1 foot the overall B.O.D. removal had been raised to 45 per cent without chemicals added.

Mr. Zack emphasized the fact that the filter (effluent straining) had seemingly been responsible for the uni-

(1) *T. R. Breuchard, and* (2) *F. H. Goodenough—Both With Municipal Sanitary Service Company.* (3) *Wallace & Tiernan's Alan Johnstone.* (4) *W. T. Carpenter, Chemist, N. Y. Dept. Sanitation.* (5) *Jas. F. Sanborn, Cons. Engr.* (6) *Guggenheim's Savage*

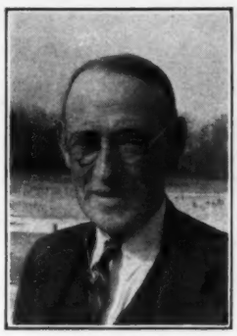
formity in effluent quality, irrespective of sharp variations in flow and quality of crude sewage—this being noted during the chemical treatment period as well as later. Observations during maximum flow periods had revealed that the 0.72 hour sedimentation period and 3.5 gal./min./sq. ft. filter loading had produced no appreciable increase in head loss through the filter, with or without chemicals being used. In passing through the magnetite layer apparently a conglomerating effect on the non-settling (colloidal) matters was had, because the solids removed in the dirty wash-water subsided rapidly, like flocculated matters, and, returned to the crude sewage, did not pass through the settling unit.

Carefully checked test runs, comparing the work of the magnetite filters with and without the use of chemicals, had been made at Perth Amboy by interested outside authorities. Averages for the 15 day chemical run revealed the filter to be responsible for a removal of 68 p.p.m. of suspended solids and 20 p.p.m. of B.O.D., the detention period being approximately 2.5 hours and filter loading 0.95 to 1.00 gal./min./sq. ft. During the 28 day period without chemicals the filter had been responsible for removing 50 p.p.m. suspended solids and 37 p.p.m. B.O.D.

Without chemicals, however, the filter effluent had contained 69 p.p.m. suspended solids (average) whereas with chemicals it had contained only 27 p.p.m. The difference in B.O.D. of the two effluents had not been so marked, viz.: 108 with chemicals compared with 167 without chemicals. During the non-chemical treatment period the flow had averaged 3.0 M.G.D.—detention approximately 3.1 hrs. and filter rate 0.82 gal./sq. ft./min. The degree of purification was evidenced by the fact that the filter effluent in July and August required only 50 lbs. of chlorine per M.G. to maintain residuals. As the cool weather appeared about half that dosage (less than 3 parts per million) was sufficient.

Sludge dewatering on Conkey vacuum drum-filters had been accomplished at rates of 7.9 to 8.4 lbs. of dry solids per sq. ft., yielding a cake of 65 to 69 per cent moisture from sludge with 10 to 12.9 per cent solids. Ferric chloride from 2.1 to 3.1 lbs. per hundred of dry solids and pebble lime from 7 to 12 lbs. per hundred had been used in conditioning. The highly alkaline cake had been dumped in a ravine without apparent nuisance.

The 13 M.G.D. plant had cost $375,000. Ferric chloride had cost $2.55 per hundred lbs. of $FeCl_3$. Pebble lime cost $12.00 per ton. Power consumed (pumping excluded) had amounted to 135 K.W.H. per M.G. during chemical treatment and 109 K.W.H. without it. It was to be considered, however, that with increasing flows, to nearer design capacity, the power consumed per M.G. would come down. Of the whole, 2.38 K.W.H. per M.G. was consumed in operating the cleaning mechanism of the Laughlin Magnetite Filter, this unit being 12 ft. wide around the 80 ft. diameter tank. At design loading of 2.00 gal./sq. ft./min. the filter mechanism required 8 K.W.H. per M.G. when



W. M. Piatt, Consulting Engineer, Durham, N. C. (Comes Up Every Year to the Annual Meeting)

H. F. N. Hodgson, Sanitary Engineer, South Australian Govt., Adelaide, Aust. (An Honored Guest)

operating continuously rather than 33 per cent of the time, as under present conditions of one-half to one-third loading.

F. W. GILCREAS, Chemist, New York Department of Health, in discussion, compared the Birmingham and Perth Amboy results with those at Liberty, N. Y., which indicated that the nature of sewage had all to do with the cost and efficacy of chemical treatment. Without actual trial, he commented, the results secured on one sewage could not be predicted for an unknown sewage. For example, a 50 per cent B.O.D. reduction on a strong sewage was more effective than a 75 per cent reduction on a weaker sewage. He commended the recent report on Chemical Treatment by the A. P. H. A. Committee on Sewage Treatment (Nov. 1935 issue of Sewage Works Journal) as worthy of study by everyone interested in chemical treatment.

L. H. ENSLOW, commented that efficient chemical control was not simple when confronted with the Perth Amboy conditions which were created by industrial wastes. The system of primary sedimentation ahead of chemical dosage, such as employed at Birmingham, might have proved of particular value in smoothing out the radical fluctuations in sewage quality such as experienced at Perth Amboy and elsewhere. The scheme of chemical sludge return to the sewer ahead of the plant at Birmingham had definite advantages, odor absorption being not the least. Both Birmingham and Perth Amboy had discovered that sludge should not be permitted to accumulate in the system or on the bottom of the clarifiers.

The performance of the magnetite straining units at Perth Amboy had been impressive. The beds of sharp grained magnetite seemed to be of especial value in periods when flocculation was imperfect due to loss of control or intentional chemical economy. There seemed to be a surface contact and sharp grain effect which in part served as a de-colloider and converted non-settleables into settleable conglomerates easily, removed by return of the solids laden wash water to the crude

(1) *Twins—Fred Welch (L. I. State Park Comm.) and Jim Welch, New York City.* (3) *The Long Island Sewage Operators' Conf. Triumvirate—Luther, Donaldson, F. Welch.* (4) *Clowning Frank Hall—the "Peanut" Is Frank Roe's (Left) Darby. Geo. Anderson (Rockville, Center) on Right.* (5) *Secy. Arthur Bedell to Henry Ryan. "A Record—45 New Members During This Meeting"*

(1) Secy.-Treas. A. S. Bedell, Prof. Gordon Fair, W. Donaldson, A. S. Fischer. (2) Plant From the Rear—Glass Cover Is Over the Settling Tanks. (3) "Professor" Raisch of Municipal Sanitary Service Corporation, Explains the Mechanical Filters at Great Neck. (4)"Doc" Mohlman of Chicago (Center) and Group Watching Sampling Operation

sewage. It was his thought that the magnetite unit was the most valuable part of the Perth Amboy plant and would receive wider recognition in all types of sewage treatment as a means of reducing solids in effluents when the treatment process became off-balance, overloaded or was curtailed for economy sake. This applied in mechanical, chemical or biological plants and especially where the mechanical straining could reduce operating costs consistent with the capital investment. At Perth Amboy the magnetite strainer had unquestionably demonstrated what it could accomplish, with and without chemicals, in producing an effluent to meet varying requirements as to degrees of purification and costs. Inexpensive in maintenance and operation and readily installed in existing as well as new plants, it had much to commend it.

"The Economics of Various Methods of Sewage Sludge Disposal"—by ANTHONY J. FISCHER, The Dorr Company, New York City.

Dr. Fischer's paper constituted an economic analysis of the several available methods of dewatering and disposal of sewage sludges. Studies reported had been made to determine the relative economy of vacuum filtration and incineration without preliminary digestion as compared to primary digestion followed by vacuum filtration (with or without incineration) as against drying on sand beds.

In an abstract the discussion by Dr. Fischer cannot be done the justice it deserves. Since the paper is of such high importance it will be published in full, with its 16 illuminating analytical graphs, in the next issue of this magazine. Amongst the conclusions reached by Dr. Fischer were the following:

(1) In filtration of raw sludges (crude, chemical or activated) and incineration, a two day sludge storage or thickening period is advisable. Even then, excess incinerator and filter capacity may have to be supplied to handle 3 to 4 times the daily average production (load) of dry solids produced by the treatment process—the criterion being the peak sludge load rather than the average.

(2) The lowest plant installation cost would in general result where sludge digestion preceded vaccum filtration. An exception to this rule was found in activated sludge, wherein the greatest economy would result when the crude sludge was digested and thereafter mixed with thickened undigested activated sludge prior to chemical conditioning and vacuum filtration.

(3) Even when providing for handling peak loads of *no more* than 125 per cent of the average daily dry solids load all sizes of plants filtering and incinerating raw sludges, would prove more costly than those designed for digestion prior to filtration. But, in plants above 15 M.G.D. installations to handle raw sludge would cost somewhat less than those designed to provide incineration of digested sludges or mixtures of digested primary and undigested activiated sludges.

(4) For plants of less than 10 M.G.D. capacity operating costs are lowest where digestion and open sand drying beds are provided. Plans of more than 25 M.G.D. capacity would in general find it less costly to employ vacuum filtration of digested sludge, with or without incineration.

(5) Raw sludge incineration seemed to prove the more expensive in cost of operation even though no provision be made to meet peak load conditions. In the case of activated sludge treatment, operating costs could be materially reduced by the combination of digested primary and thickened undigested activated sludge prior to filtration.

(6) The Genter process of elutriation (sludge washing) might be profitably used in the preparation of all digested sludges prior to chemical conditioning for mechanical dewatering. Especially economical would be the combination of the short 20 day digestion and elutriation.

(7) Trends toward the future would seem to favor vacuum filtration in relatively small plants, with the possibility of drying and marketing the sludge as fertilizer locally. In the larger plants sludge incineration deserved more consideration and should find widespread application.

Dr. Fischer explained that his conclusions could not be taken to fit every case but were in general applicable. They had been drawn as the result of the use of known cost data, published and unpublished. His full paper will, without much question, create controversy and receive careful study by sewerage engineers and municipal authorities. It will appear in March.

A. L. GENTER, inventor of the sludge elutriation process, read a prepared discussion by C. E. KEEFER of Baltimore which pointed out the greater economy of vacuum filtration of digested elutriated sludge at Baltimore over sand bed drying. Mr. Genter added that he concurred with Dr. Fischer's conclusions that partial digestion and mechanical filtration was the most practical as well as economical method for future consideration. A partially digested sludge containing 60 to 70 per cent volatile solids elutriated with 3 volumes of water or sewage effluent would require not more than 1 per cent of ferric-chloride conditioner ($FeCl_3$ to dry solids in sludge) as compared with several times that quantity for undigested sludges or un-elutriated digested sludges.

"Features of the Great Neck (L. I.) Sewage Treatment Project"—by JOHN V. FENTON, Carman-Dunne, Engrs., Lynbrook, L. I.

Mr. Fenton described the sewerage system and the novel treatment plant (2 M.G.D. capacity) recently completed as a PWA project for Great Neck, L. I. It involved pre-chlorination, preliminary sedimentation of 1 hour and filtration of the settled sewage through low

vacuum drum type filters, the process involving the addition of paper pulp, which served as the "blanket" on the filters, and filtration at 3 gals. per sq. ft. per min. For a higher degree of purification the use of coagulants were anticipated when required. For the present the paper pulp alone was sufficient, the re-use of which reduced the consumption to 150 lbs. of news print stock per M.G. treated. The losses represented the fibers washed out with the sewage solids returned to the settling unit. The crude sludge plus paper fibers from the clarifier was dewatered on a vacuum unit and the cake hauled to the garbage incinerator. For sludge dewatering, lime was employed to produce a cake of 75 per cent water content or less. Sludge thickening prior to conditioning was accomplished in a holding-decanting tank, chlorine being added when necessary to check decomposition.

Unique features were: The automatically controlled speed of the filter revolution to compensate for varying degrees of loading, filterability of sewage or permeability of the pulp blanket; remote and automatic control of all mechanical units in the plant and a telephone alarm system; compactness of plant (3,600 sq. ft. for 2 M.G.D. plant), and freedom from odors; spray piping for cleaning down the walls of filter vats, pulp tanks; automatic filter effluent pumps supplying the washing-down and pulp washing water; glass-covered settling tank at slight extra cost; chlorinator location on the upper floor with chlorine cylinders located on the ground floor and piping up of the gas; the mechanized ventilating system; attractive design of pumping stations located in high cost residence area.

The project (sewers, pump stations and plant) had cost $613,000 which drew a Federal grant of $180,000 reducing the cost to the municipality to $433,000.

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Mr. Hopkins Explains

Edward S. Hopkins' article "Short Schools and Licensing," which appeared in our December issue, carried his title as Principal Sanitary Chemist, Montebello Filters, Baltimore, Md. The article, as received, carried two other titles viz.: "Chairman of the Initial Short School Committee of the Maryland Water and Sewerage Association" and "Chairman of the Sanitation Division of the American Chemical Society."

We have seemingly done Mr. Hopkins an injustice in utilizing the title that gave him the voice of an operator, which we assumed the article to represent. In a letter, Mr. Hopkins states that his authority for the discussion on "Short Schools and Licensing" would have been shown by the deleted titles, whereas the one used failed to do so.

We regret that the space available for Mr. Hopkins' article and the desire to print it in the December issue necessitated considerable condensation of it, including deletion of the two authoritative titles. Such a happening is regrettable.—Editor.

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On Operator Licensing (A Letter to the Editor)

Dear Sir:

In the article entitled, "Short Schools and Licensing," in your December issue, Mr. Edward S. Hopkins discusses a subject which should be the immediate concern of the engineering profession. The fact that state licensing has long been recognized in the medical and legal professions and that it is rapidly gaining ground in the engineering profession has apparently been disregarded.

Professional engineers only are qualified to control the operating requirements of the works they design. If we have to depend on the understanding of political office holders on engineering matters, there will be no protection of the public, which is the primary object of licensing. It does not need much experience to show that education of municipal office holders as suggested by Mr. Hopkins would be impractical. Legal procedure is the only means of obtaining control. Under the process of law, a person can be prosecuted, but if there is no law, there will be confusion. Without laws, even conscientious minorities would be powerless against a political machine.

With a license law in force there is only one road to follow, whereas, an attempt to educate each incoming administration would be futile.

Operator licensing should be a function of the various state boards of engineering examiners who also license professional engineers.

Municipal licensing of operators should be abolished. It is a handicap as well as an inconvenience to qualified operators. State licensing of operators would qualify a man to operate a plant anywhere in the state and would also have the advantage of being a uniform requirement throughout the state.

A person licensed as a professional engineer should need no further license for engineering work of any kind. Engineers should get together for the adoption in every state of professional engineers' license laws patterned as closely as possible to the Model Law. They should also bend their efforts toward the adoption in every state of uniform license laws for operators in steam plants, electric plants, chemical plants, etc. The various schools could then very easily adapt their curricula to the legal requirements. State licensing should be considered the lower crust through which a man should break in order to qualify. The public should be satisfied with no less.

Mr. Hopkins thinks that regulation would not raise the standards. The reverse would seem to be more in order, for regulation in both the medical and legal professions has been beneficial.

Under state law requiring qualified operators under the supervision of a licensed professional engineer, the public needs would be much more satisfactorily met than by an educational program alone, which it seems would be not only ineffective but impractical.

HAROLD R. TOWSE, Rockville Center. L. I.

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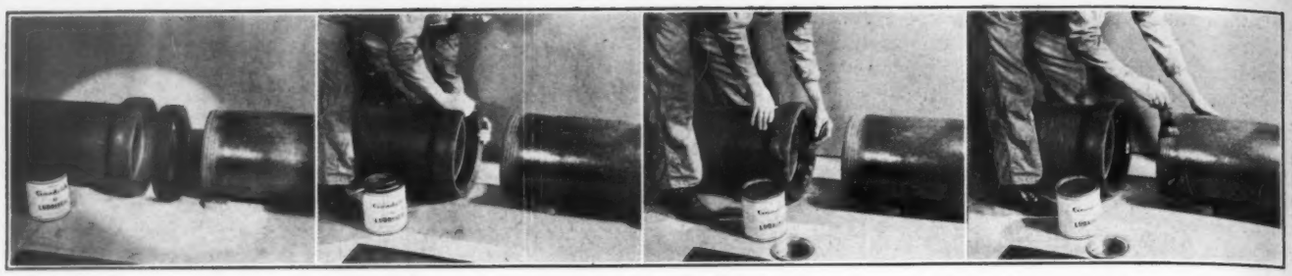
Daniel W. Mead, LL.D., Elected President of A. S. C. E.

Daniel W. Mead

The American Society of Civil Engineers has honored Daniel Webster Mead by electing him President of the Society for the year 1936.

A graduate of Cornell University (1894), Mr. Mead, who served as City Engineer of Rockford, Ill., later became general manager of a construction company and thereafter entered private practice as a consulting hydraulic and power engineer. From 1904 to 1932 he held the Chair of Sanitary and Hydraulic Engineering in the University of Wisconsin, which bestowed upon him the honorary degree of Doctor of Laws upon his retirement. He is now a member of the engineering firms, Mead & Seastone, Madison, Wis., and Mead & Scheidenheld, New York.



From Left to Right Is Shown the Flexlock Rubber Joint and Operations in Pipe Jointing With It

RUBBER PIPE JOINTS
A New Development for Ceramic Pipe

By T. D. NATHAN*

Akron, Ohio

THE use of rubber gaskets in pipe joints is by no means a recent development. Records show that a rubber pipe joint was first commercially adopted in Wooster, Germany, in 1847 and was later used by several municipalities in both England and France. First United States patents for rubber-sealed mechanical pipe joints were issued to S. R. Dresser in 1887. The company which he founded has since that time successfully applied rubber in pipe joints for over 100,000 miles of pipe line devoted to the transportation of oil, gas, water and other fluids.

The record of rubber in this service is an impressive one. A four inch rubber gasket was removed from an underground gas line and was found to be in excellent condition despite its forty-six years of service. In Detroit a 16 inch steel pipe line, which had been installed in 1898, was removed recently because of pipe corrosion but the rubber gaskets were found in good condition and the joints were still tight. In the city of Bradford, Pa., rubber gaskets have been in use for forty-five years in water service lines. A short time ago one of the couplings was removed and the rubber gasket returned to The B. F. Goodrich Company to be checked against the original formula which was still on file. A careful analysis showed little or no deterioration.

Despite this enviable record of rubber as a jointing material, little thought or effort had been given until recent years to the possibility of developing a rubber gasket suitable for joining bell-and-spigot pipes. In the field of sewer construction, attempts to perfect a permanent, water-tight and root-proof joint apparently has been quite a problem. Cement joints because of their inflexibility are apt to spring a leak due to settling of the line or expansion and contraction or earth tremors. Joints made from plastic or bituminous materials, while possessing greater flexibility are still subject to leakage, particularly when exposed to corrosion. These types of joints also necessitate a certain amount of involved work and are almost impossible to install satisfactorily in a wet ditch.

Rubber Joint Developed for B & S Pipes

Since the B. F. Goodrich Company pioneered in the manufacturing of rubber gaskets for gas transmission and service lines, it was only natural that they should turn their efforts towards the development of a suitable rubber product for low pressure ceramic pipe. After several years of concentrated laboratory and field work this company has developed a rubber joint for ceramic bell-and-spigot pipe known as the "Flexlock" Joint. It is now available for use with specially constructed ceramic pipe in low pressure service (usually limited to a maximum of 15 pounds per square inch) and in temperatures not exceeding 175 degrees Fahrenheit.

The Flexlock Joint is extremely simple both in its design and application. It consists of a rubber gasket having internal and external circumferential ribs which grip the bell and the spigot of the pipe. While the

Installing "Flexlock" Rubber Joints on a Large Sewer Project

*Engineer, The B. F. Goodrich Company, Akron, Ohio.

One Form of Yoke Type Puller Used in Jointing the Large Size Sewer Pipe

gasket permits easy insertion of the spigot, the shape of these corrugations, combined with the resilience of the rubber, forms a *multiple seal* which resists any tendency of the pipe sections to pull apart. The effect of pressure serves to make the joint tighter and assures no leakage in or out, thereby eliminating an important hazard and also sewage works and pump-stations overloading.

Inasmuch as it is definitely known that roots will enter a sewer joint only where there is leakage, the Flexlock Joint obviously eliminates bothersome root troubles. Because of its resilience, this joint permits a certain degree of angularity between the joined sections. Thereby, settling of the pipe or other disturbances to a reasonable degree cannot affect the tightness of the joint. Joints cannot be broken by expansion or contraction due to temperature changes. Pipes can be leveled and bedded to grade after the joint is made. Danger of pipe breakage due to pressure or vibration is minimized because the rubber gasket tends to cushion the pipe and absorb shocks.

The ability of rubber to resist age and deterioration is conclusively proved by its excellent record in water and gas pipe line service, which we have referred to previously. Installation in an underground pipe line represents ideal storage conditions for rubber, because the commonest factors of deterioration—light, heat, and air—are eliminated. The composition employed in the Flexlock Joint incorporates the most up-to-date improvements in rubber compounds to insure long life. One of the most important ingredients of this compound is Agerite, which, when mixed in small quantities with rubber, combats oxidation in a manner likened to the action of chromium in steel.

The certainty of preservation is not impaired by corrosive conditions. The corrosives present in sewers have practically no effect on rubber. As a case of record one may cite the corrosive action of natural gas condensates with which rubber pipe joints have for some years successfully contended in gas pipe-lines. In fact, one of the most useful applications of Flexlock Joints has been in chemical plants where other types of joints have been quickly eaten away by corrosive chemicals.

The Flexlock Joint can be applied by the contractor and requires no special skill. It simplifies and lessens time and cost of laying pipe and making water-tight joints. It eliminates the use of jute packing, mortar mix and operations necessary when utilizing jointing materials that require heating.

Simplicity of Jointing

To make a joint: First, the Flexlock gasket is placed in the bell socket (see illustration). The inside surface of the rubber and the outside contact surface of the spigot are then lubricated with Lubriseal, a special liquid lubricant adapted by Goodrich for use with rubber. The spigot is then pushed into the bell, then engaging the joint. In pipe sizes which can be readily handled, the joint may be made without any equipment. On larger sizes, the pipe may be propelled together by means of a block and crowbar or a simple yoke-type pulling device.

Because of the joint design, the pipe is automatically centered and self-aligning, providing a continuous smooth flow and reducing frictional losses. Since this joint is not affected by water, it can be easily applied even though in a submerged position.

The Flexlock Gasket is produced in two types. One is for use with Flexlock specification vitrified sewer pipe and the other for Flexlock specification chemical stoneware pipe. Both types of gaskets and pipe are available in a range of sizes up to 36 inches.

The low pressure Flexlock Joint may be used for all types of drain work involving the handling of water, sewage, or industrial wastes. Several thousand of these joints are already in successful use on acid drain lines, fume lines, metal pickling-tank drainage and sewers.

Acknowledgment.—The Flexlock Joint was developed for vitrified clay pipe in cooperation with Robinson Clay Products Co. of Akron. For chemical stoneware pipe it was developed in cooperation with the U. S. Stoneware Co., also of Akron.

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A. W. W. A. Directors Express Opinion On Federal Stream Control Policies

By the Directors of the American Water Works Association, in meeting January 16, 1936, in New York City, the following important action was taken in an endeavor to discourage the passage of laws by the present Congress which may result in giving to the Federal Government too extended jurisdiction over sources of water supply in America. The intent was to preclude possible embarrassment of or detriment to individual states and their political subdivisions.

The resolution, introduced by Abel Wolman, was unanimously endorsed by the Directors of A. W. W. A., and we understand that the same or a similar resolution presented to the Directors of American Society of Civil Engineers was also endorsed.

The Resolution:

"It is the judgment of the Board of Directors of the American Water Works Association, that if and when legislation is introduced in the Congress of the United States to place the control of the pollution of water under the Federal Government, the Committee on National Water Policy (A. W. W. A.) be authorized to appear before the appropriation Congressional Committee on this subject to advise it of the policy of the American Water Works Association to the effect: That, for the present, no further extension of Federal control over streams is desirable; that the Federal Government should restrict its activities in this field to functions of fact-finding and coordination and stimulation of state and interstate programs; and, that the initiation, administration and financing of projects should be reserved to state and interstate action."

DRY FEEDING CHEMICALS
Some Experiences at Norfolk, Va.

By R. W. FITZGERALD

Chief Chemist, Division of Water Supply
Norfolk, Va.

The Author

THE two Norfolk water purification plants were originally designed with solution chemical feeding equipment. The first dry chemical feeders were installed in 1925 to feed lime. This installation was made as a result of considerable difficulty experienced in the handling of milk of lime suspension, both in the storage tanks and in the delivery lines.

The feeders selected were Wallace & Tiernan, Type "B" of which Fig. 1 shows the details of construction. This type of feeder was substantially constructed and has, in our case, served its purpose quite well. Two of these units were placed in service simultaneously and are still being used in our plants to handle hydrated lime. The principal drawback to these feeders is that, owing to the fact that neither the hopper nor the feed table is housed in, considerable dust is occasioned in operation. This is particularly true in handling light fluffy materials, such as hydrated lime. This style of feeder is now obsolete and Wallace & Tiernan are offering improved models in their place.

The next addition to our dry feed equipment came in 1931, when the use of activated carbon was adopted as standard practice in our plants. We first attempted to feed this material as a water suspension, which was prepared in large quantities and fed through orifice boxes. Experience soon proved that the carbon particles, when stored in a water suspension, became waterlogged and thereby lost much of their efficiency. To eliminate this difficulty, two Wallace & Tiernan, Type "O" chemical feeders, were purchased to handle activated carbon.

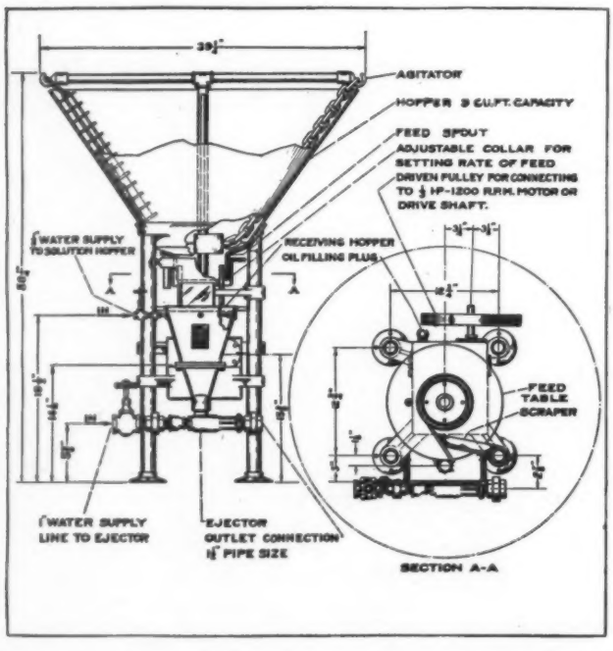
AGITATOR
HOPPER 3 CU.FT. CAPACITY
FEED SPOUT
ADJUSTABLE COLLAR FOR SETTING RATE OF FEED
DRIVEN PULLEY FOR CONNECTING TO ½ HP-1200 R.P.M. MOTOR OR DRIVE SHAFT.
WATER SUPPLY TO SOLUTION HOPPER
RECEIVING HOPPER OIL FILLING PLUG
FEED TABLE SCRAPER
WATER SUPPLY LINE TO EJECTOR
EJECTOR OUTLET CONNECTION ¼" PIPE SIZE
SECTION A-A

Fig. 1.—Wallace & Tiernan's Early Type "B" Feeder. Our First Installation of Dry Feed Equipment (1925) *Consisted of Two of These Units*

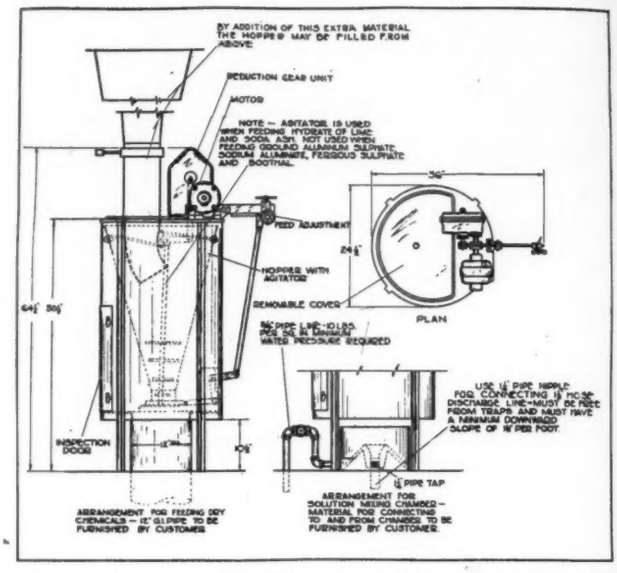

Fig. 2.—Wallace & Tiernan's Type "O" Feeders. Two Units Installed in 1931

The construction of these machines is shown in Fig. 2. Although these feeders have served their purpose to a greater or lesser degree during the last four years, we have experienced considerable trouble and expense in their operation and maintenance. The location of the driving motor so near the point for charging chemicals is a serious handicap to the successful operation of these machines. This is especially true in the use of activated carbon or powdered lime, inasmuch as the motors become clogged with dust when the materials are being charged in the hoppers. It has been necessary to install eight new motors during the 4-year period of service of these two units. It has also been our experience with this type of feeder that almost constant observation of the unit must be maintained in order to insure continuous and accurate feed.

Plant Put on 100 Per Cent Dry Feed

In 1932 it was decided that more efficient operation might be had by completely equipping our plants with chemical dry feeders, and this was accomplished by the purchase of two new feeders for handling powdered alum. After a thorough investigation of the available equipment on the market, the Omega Universal Feeder, Type "2R" was selected as best fitted for our needs. Time has proven this selection a wise one. These machines have now been in continuous service for approximately four years with a maintenance cost of less than $10.00 on the two units.

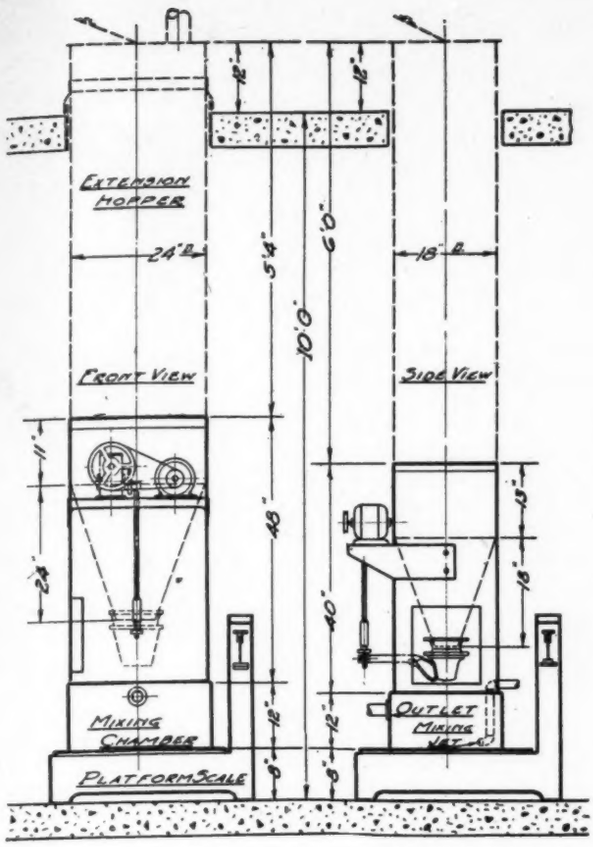

Fig. 3.—The Omega Universal Feeder—Type "2R." Two Units Installed in 1932

The construction of this feeder is shown in Fig. 3. It is equipped with an extension hopper which permits charging from the storage floor above. The feed-table and oscillating hopper are entirely enclosed. These two features permit the handling of finely ground materials without exposing the driving motor to excessive dust and dirt. The solution chamber forms the base upon which the body of the machine is supported. The entire unit is mounted upon a fifteen hundred pound platform scale. This makes possible an accurate check of the amount of material being fed during any given period of time. Agitation in the solution chamber is furnished solely by the mixing water jet. The alum solution flows from the solution chamber to a receiving box from which it is ejected to the raw water by hydraulic ejector. The amount of material fed may be regulated either by the length of the stroke of the lower hopper or by the distance of clearance between that hopper spout and the feed table. The range of feed of these particular units may be varied from three hundred pounds to six thousand pounds per twenty-four hours. We have found this machine to be one of the most serviceable of any of the heavy duty dry feeders with which we are familiar.

New Type of Feeder Tried

The latest addition to our dry feeding equipment was purchased in July 1935. It consists of two Syntron Chemical Feeders, Type "FM 1-25." These feeders were purchased to feed activated carbon. The electro-magnetic vibration principle upon which this machine operates, although quite simple, is unique and bids fair to be revolutionary in the field of dry feed equipment.

As shown in Fig. 4, the construction of this feeder is very simple. It consists of an inverted conical hopper mounted on a suitable frame over a feed trough. On the side of this hopper is attached an electro-magnetic pulsating unit. Attached to the bottom of the feed trough is a similar unit. The electric control-panel consists of two vacuum rectifying tubes, two rheostats for controlling the amount of current fed to the magnetic vibrators, and a mercury contact switch which permits automatic operation of the machine intermittently, if so desired. The rate of pulsation of the electro-magnetic units is constant at 3,600 vibrations per minute. Only the *force* of the vibrators is varied by the means of the rheostat. The amount of material fed may also be varied by two adjustments which open or close the orifice (clearance) between the hopper spout and the feed trough. The rate of feed may be controlled very accurately, thereby, and covers a range of from one-half ounce to five tons per hour, depending upon the machine setting and nature of material fed. We ran these machines experimentally, using powdered alum, soda ash, hydrated lime and activated carbon. They handled all of these materials equally well. This unit is the most successful one we have yet seen for handling activated carbon. There are no moving parts except the electro-magnetic pulsator and it requires absolutely

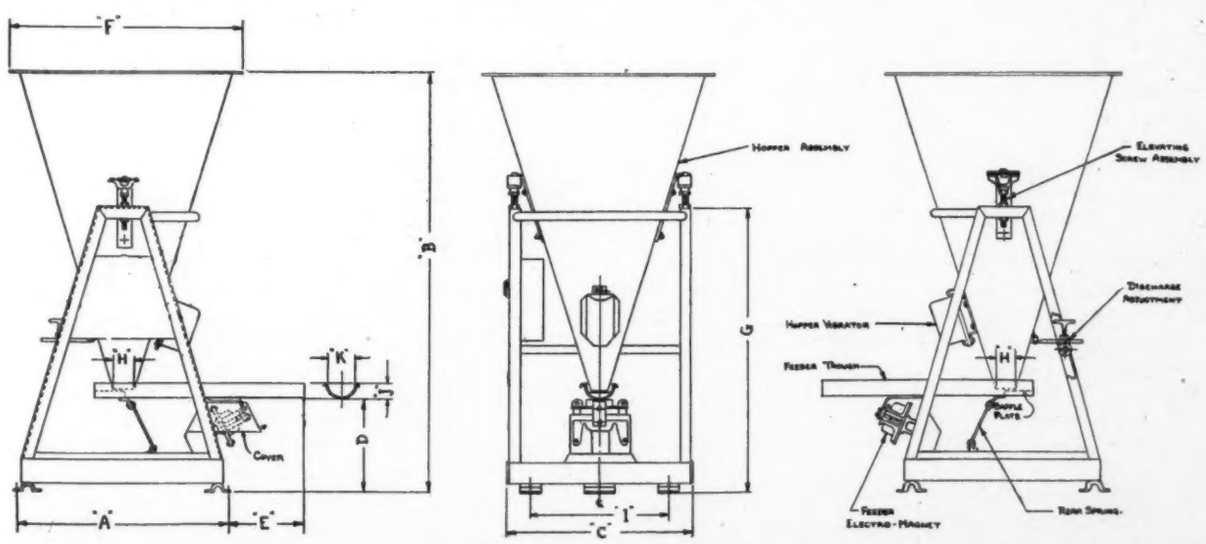

Fig. 4.—The Syntron Pulsating Electric Feeder—Type "FM 1-25." *The Latest Installation, Two Units Being Installed in* 1935

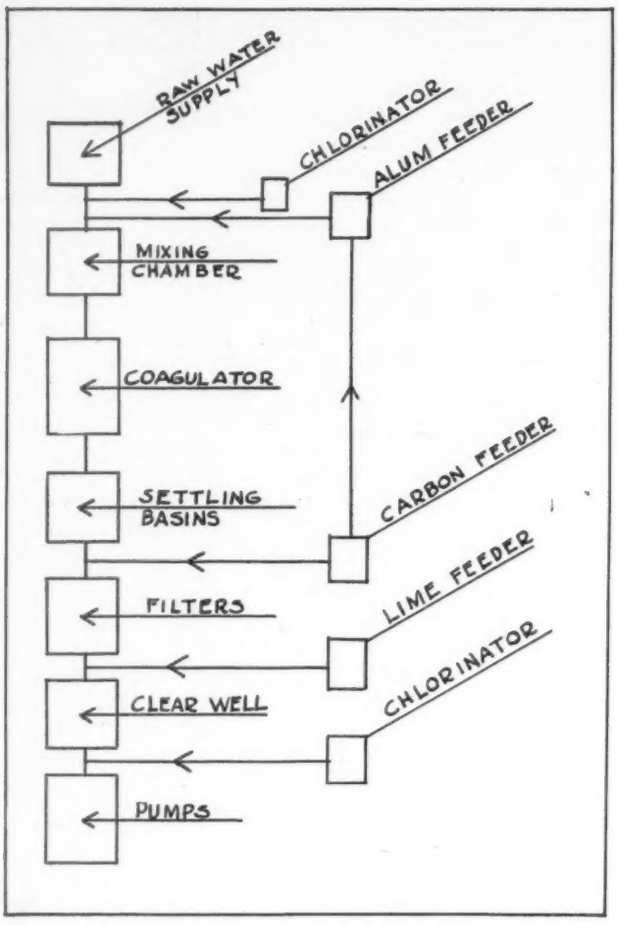

Fig. 5.—Flow Diagram Showing Points of Chemical Applications at Norfolk Plants

no lubrication and operates very quiet and with a very moderate current consumption. We have been highly pleased with the performance of these feeders during the more than 6 months of use.

Fig. 5 is a crude flow diagram of our plants which indicates the points of application of the various chemicals.

Since the adoption of the "dry" system of feeding chemicals, we have drawn the following conclusions:

Summary

(1) Dry feeding equipment is much more economical from the standpoint of space occupied.

(2) It permits of more accurate feed control and furnishes a double check on the amounts used.

(3) It increases the tidy appearance of the plant.

(4) In our case, it has proved itself also a more efficient and a more economical method than the old solution system.

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Hand Book of Chemistry and Physics (A Review)

Chemical Rubber Company of Cleveland, Ohio, has issued the 20th Edition of its "Handbook of Chemistry and Physics" which contains many revisions and additions to make a volume of almost 2,000 pages, measuring 4⅛ by 6½ inches. The new edition is divided into five sections, separated by stiff colored paper inserts to facilitate use of the book and quick location of subject matter.

Since its introduction in 1913 the now famous "Handbook of Chemistry and Physics" has grown in size and importance each year, although the price ($6.00) remains the same.

Mark B. Owen Made Vice-President Nichols Engineering Corp.

Mark B. Owen

Mark B. Owen, formerly Superintendent of the Department of Public Works and Engineering of the City of Dearborn, Mich., has been made Vice-President of the Nichols Engineering and Research Corporation of New York. Mr. Owen, one of the best-known sanitary engineers in the country, has been responsible for the inauguration of many new and novel ideas in public works administration, construction, maintenance and operation. He is a member of many municipal engineering organizations, and was only recently elected President of the International Association of Public Works Officials.

A product of the University of Michigan, Mr. Owen went with the firm of Hubbell, Hartgering & Roth, and therefrom to serve Dearborn, Mich., as chief inspector of all construction work. In 1928 he was appointed Superintendent of Public Works and Engineering of Dearborn, the position he leaves to accept the new position with the Nichols Engineering and Research Corp.

Mr. Owen has won a reputation in his chosen field in the matter of the drafting of model codes to regulate building and plumbing, and also in municipal physical laboratory design and testing. In two recent important developments in the sanitation field he is known for his pioneering. The first of the modern chemical treatment plants in America was ordered designed and was built under his jurisdiction; the first sewage plant to adopt incineration of sludge was that under his supervision at Dearborn. Both constitute the newest developments in sewage treatment practices.

The Nichols Engineering and Research Corp., of which Mr. Owen has been made a Vice-President, designed and installed the Dearborn incinerator. This corporation has recently been returned to the control of Mr. C. W. Nichols, President, who has acquired a majority stock interest from Phelps Dodge Corporation.

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Aurora Wins in Odor Suit

A suit brought against Aurora, Ill., claiming damages to the business of an owner of resort cottages on property adjoining the Aurora Treatment Plant (sprinkling filters) was recently decided in favor of the defendant city. Interestingly enough the failure to find in favor of the plaintiff was the verdict of a jury whereas the reverse is the rule in almost every case of trial before jury. In this case Robert J. Wing, local district attorney, Walter E. Deuchler, engineer, and Walter A. Sperry, superintnedent of the Aurora Sanitary District must have done an excellent job. The plaintiff claimed $20,000 damages suffered because of bad odors emanating from the sewage treatment works. The jury which visited the plant during the suit (December) found it odorless. Laboratory records, of tests made three times daily of the settled sewage to the filters during summer, failed to show sufficient hydrogen sulphide to create an odor nuisance. The defendants also proved and stressed the fact that local service and community clubs frequently held picnics on the plant grounds. Plant beautification and good public relations have again paid.

AIR CONDITIONING IN RELATION TO WATER CONSUMPTION

By LOGAN L. LEWIS*
Newark, N. J.

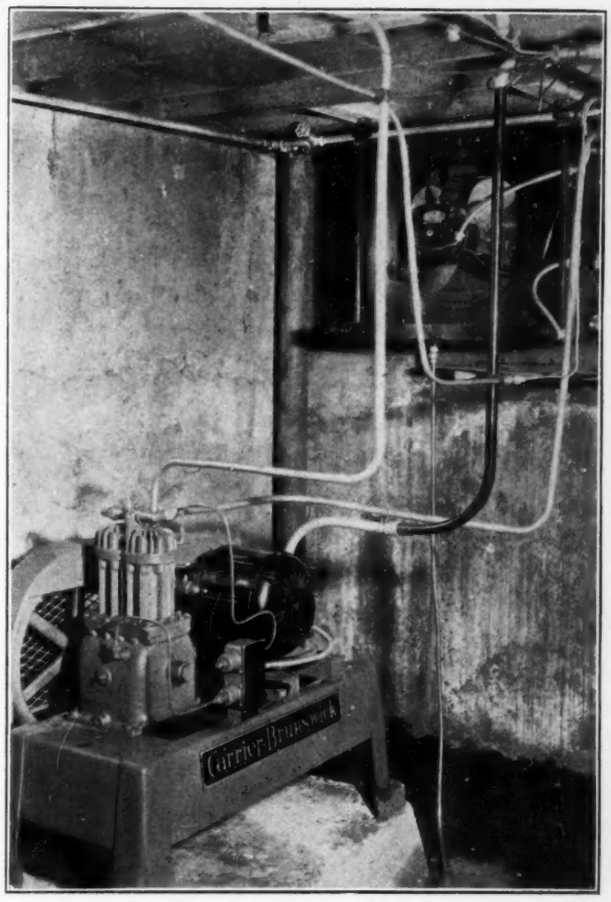
I AM delighted with the thought that water works authorities are determined to give serious consideration to the matter of air conditioning in its relation to water consumption, for I believe that it requires careful planning on the part of many water works managers. This planning will require an examination of the adequacy of supply, of pumping equipment as to maximum demand, and of distributing systems with reference to the focal points of that maximum demand.

While it may be true that air condition has but recently become of peculiar but important interest to water works authorities, it is by no means a novelty. The industry is some thirty years old. During the first twenty years of its life, application was limited almost entirely to industrial plants and, hence, few people knew of it. About ten years ago its application began to spread rapidly to theatres, department stores, restaurants and other buildings in which the public gather. This second phase of development brought improvements in equipment, made price reductions possible, and greatly broadened the market. For example, only a few years ago, Jones would have paid $10,000 for air conditioning his corner drug store, and would have been compelled to hire two licensed refrigerating engineers to operate his plant. Today, Jones can buy better equipment for less than $3,000 and can operate it himself with push buttons or thermostatic controls, placed in any convenient location in his store. It has now become a money-maker for Jones.

From an air conditioning point of view, every human being in Jones' store is a heater, giving off heat in both its sensible and latent form, or, with freedom of description, as dry and moist heat. Every light, every electrical device, every coffee urn is a heater. The rays of the sun heat the building structure where they strike it, and heat also flows in through it, because a lower temperature is maintained inside the structure. Therefore his system must remove heat and moisture when the weather is warm and add heat and moisture when the weather is cold.

For effectively removing heat, he must have a refrigerating machine of which there are many types, all of which must be provided with means for removing the effluent heat. For example, a very elementary definition of a compression machine resolves it into three parts: The cooler, which receives heat at a low temperature or head, the compressor, which raises the pressure of the refrigerant so that the heat received by the cooler can be removed at a relatively high temperature or head, and the condenser from which the heat is finally removed. This effluent heat usually is carried away wholly or partly by the water furnished, and requirements may be great. In winter, when heat is added, Jones' requirements for water are minute. Thus, his demand for water is a seasonal one and proportional to the quantity of heat which must be removed.

A simple way for him to get rid of this heat is to buy water from the water utility and pass it through his condenser to the sewer. If this were the only way for him to do it, water departments might well be concerned by the demand. But, in certain cities, the cost of water was high and the manufacturers of air conditioning and refrigerating equipment sought means of reducing water costs. And, so, economic forces began to stimulate the development of equipment which would reduce sales resistance by reducing the need for water where the rates were high, or where the threat of water shortage might restrict its use. This has borne fruit, so that there is available water conserving equipment which may, in some localities, reduce sales that water works managers would like to make. However, in other localities this improvement may prove a desideratum in reducing excessive demands.



A 3-Ton Refrigeration Unit with the Compact Evaporator Condenser (Upper Right) Used in Modern Air Conditioning. No Spray-Tower, No Wind Losses.

The Economy of the Cooling Tower

The first stage of this development was the cooling tower—that slatted structure which you will recognize as the architectural abortion you have seen upon the roof of some local ice plant. This cooling tower is a means of heat disposal. The water passing through it is recirculated, being pumped through the condenser where it receives heat, and then through the cooling spray tower where it gives off this heat to the air. Some

*Chief Engineer, Carrier Corpn., Newark, N. J.

TABLE I
DEMANDS OF SEVERAL TYPES OF AIR CONDITIONING INSTALLATIONS FOR WATER

VALUES ARE PER PERSON
SEASON OF 120 DAYS
WATER COOLED CONDENSERS

	BTU/HR.	MAX. DEMAND GAL./HR.	HRS. OPERATION PER SEASON	GAL./SEASON AT MAX. DEMAND RATE	LOAD FACTOR PERCENT	PROBABLE USE GAL./SEASON
RESIDENCE	4,000	40	2,900	160,000	30	48,000
TRAIN	1,400	14	1,200	16,800	50	8,400
OFFICE	4,700	47	1,200	56,400	40	22,500
LUNCH ROOM	1,600	16	900	14,400	50	7,200
RESTAURANT	2,000	20	1,200	24,000	60	14,500
DRUG STORE	2,000	20	1,800	36,000	60	21,500
THEATRE	1,000	10	1,500	15,000	30	4,500
DEP'T. STORE	1,600	16	1,200	19,200	60	11,500
AVERAGE	2,300			42,500		17,200

of the water is carried away by the wind, some of it is lost by evaporation, and that which is lost must be replenished from the source of water supply. This loss is quite small, so that the use of this cooling tower for heat disposal has cut the demand for water to less than 10 per cent of what it would otherwise be.

To be fair to the cooling tower, it must be said that much has been done to improve its appearance. The second stage was the development of the evaporative condenser, in which the functions of the condenser and the cooling tower have been combined. The features of water conservation have also been further improved thereby and the space occupied by equipment greatly reduced. This piece of equipment may be placed upon the roof of a building and appear as a small rectangle, or, if it is feasible to lead air to and from it through ducts, it may be tucked away in one corner of the machinery room.

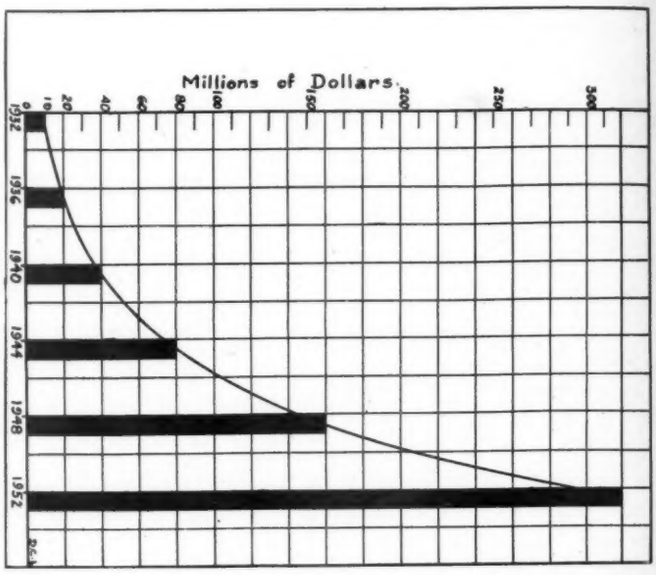
Since there is no windage loss from the evaporative condenser, it requires less than 5 per cent of the water which you would otherwise furnish. Both the tower and the evaporative condenser are instruments for the conservation of water and are fully developed practically and commercially.

Resultant Water Demands of Modern Equipment

What is the magnitude of this demand for water going to be and what will be its characteristics? Let us examine the demands for water of the several types of prevalent installations of air conditioning, which are given in Table I which accompanies this discussion.

B.t.u., or thermal units, per person will vary somewhat for each installation, but limits of variation are well known. Hours of operation per season can readily be set for maintenance of the desired conditions. Load factors, or the relation of average load to maximum load, are based on experience. Gallons of both maximum and average demand must be based on an average water temperature and an average balance between water and power. Hence, Table I is necessarily composed of figures which are admittedly controversial as to the interpretation of experience, for multifarious economic forces press in some localities for excessive use of water and in others for conservation thereof.

For a given electric power rate, cold water may throw the balance in favor of heat disposal entirely by water—warm water may do the opposite. Low power rates may favor conservation of water—high power rates, the opposite. A combination of high's of water temperature and power cost operate strongly in favor of heat disposal by evaporation.



Curve of Air Conditioning Sales Volume if Annual Sales Double Each Year

The complexity of these economic forces becomes apparent when it is realized that power for air conditioning may cost from less than 1 cent per K.W.H. to more than 3 cents; that water may be purchased at rates varying from 45 cents per 1,000 cu. ft. up to $2.85—perhaps higher; that the temperature of the water coming from mains may range in summer from 56 to 85 degrees F.; and that pocketbook limitations to available capital may enforce the purchase of equipment which, being of low capacity, is above average in demand for water or power, or both.

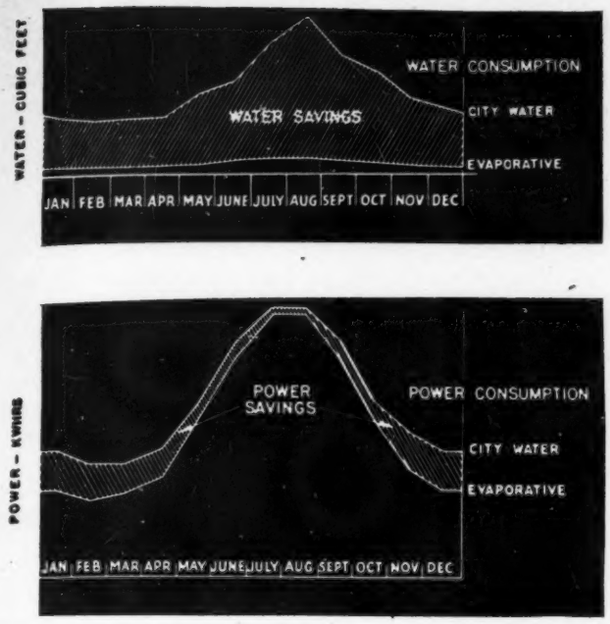
But, let's continue our examination of the average arrived at in Table I as they are carried forward in Table II. Three important facts become obvious.

First, that the demand for water is seasonal. It is high in summer and, as previously stated, insignificant in winter. An 120-day cooling season is typical of New York. In the South, it may exceed 150 days.

Second, that economic forces and restrictive regulations, such as are now applied in New York, did, in 1935, lead to extensive purchase of evaporative heat

TABLE II
AIR CONDITIONING REQUIREMENTS FOR WATER
GAL./PERSON
THE FOLLOWING ARE "COLD AVERAGES", ADMITTEDLY CONTROVERSIAL AS TO THE INTERPRETATION OF EXPERIENCE.

	NO EVAPORATIVE CONDENSERS OR COOLING TOWERS USED.		BASED ON USE OF EVAPORATIVE CONDENSERS OR COOLING TOWERS ON 60% OF INSTALLATIONS. 1935 EXPERIENCE	
	IF MAX. DEMAND IS SUSTAINED.	PROBABLE USE	IF MAX. DEMAND IS SUSTAINED.	PROBABLE USE
PER SEASON OF 120 DAYS	42,500	17,200	17,000	7,000
PER DAY FOR SEASON OF 120 DAYS	350	140	(140)	60
PER DAY FOR YEAR 365 DAYS	120	50	50	(20)



Water Conservation Made Possible by Use of Modern Evaporation Condensers

disposal systems. As a result, water consumption was cut by 60 per cent.

Third, that within the cooling season, the peak demand is far above average consumption.

Two figures in Table II are of such importance that they have been encircled. Note carefully that they are *not* the *per capita* consumption that water works men are accustomed to using.

Air-conditioning-wise, they will become per capita consumption if and when air conditioning installed and operated for the entire population served by the water system. This does not mean that every building in a city must be completely conditioned. It does mean that the sum total of the number of people upon which the capacity guarantees of the systems are based has reached the sum total of population. In still other words, it means that there will exist an air conditioned spot for each and every person in a city, and no more. In my opinion, an early achievement of that Utopia condition is beyond the most pleasant dreams of the air conditioning industry.

The accompanying curve shows what annual sales of air conditioning would be if they could be doubled regularly every four years.

If air conditioning is sold at such a rate, at some time in a period between 1945 and 1950 the per capita demand upon water systems for modern air conditioning will become:

(1) Maximum rate—35 gallons per day per capita.
(2) Average rate—5 gallons per day per capita.

Provided the present practice of using evaporative condensers and cooling towers is maintained. But if evaporative condensers and cooling towers be used exclusively from now on and be substituted for existing condensers now wasting water, then these two rates would be cut to:

(1-a) Maximum rate—23 gallons per day per capita.
(2-a) Average rate—3 gallons per day per capita.

No process of averaging out, however, can prevent the other fellow's sore leg from hurting him. Water works managers may be divided, therefore, into two groups:

1. Those to whom air condition offers an opportunity to sell more of their product.

2. Those to whom any increased demand will present a serious problem, or who may now be unable to meet existing demands if rainfall is below average.

My conclusions are:

(a) With respect to Group 1: The maximum demand of 23 to 35 gallons per capita per day may overtax existing water works pumping equipment or, if not that, the capacity of the mains at certain focal points.

(b) With respect to Group 2: Their inability to assure a continuity of supply, either at present rates of consumption, or at present rates plus 3 to 5 gallons per capita per year average, or to pump and distribute as in (a), should be faced squarely as the facts stand, and proper restrictive measures instituted.

(c) Generally: That the number and complexity of factors are such that the problem will not yield except to analysis of a specific survey.

(d) That it is to our common interest to know and face the facts; and, worth our mutual effort to obtain them.

Acknowledgment.—The above paper is based on a talk made by the author before the N. Y. Section of A. W. W. A., December 27, 1935.

William W. Hurlbut Next President of A. W. W. A.

W. W. Hurlbut

At its meeting on January 16th, the Directors of the American Water Works Association named William W. Hurlbut of Los Angeles as their choice in nominating the next president of the Association. Such nomination is tantamount to election.

Mr. Hurlbut has just completed his 28th year of service with the Bureau of Water Works and Supply of the City of Los Angeles. He was born in Cheyenne, Wyoming, and received his education in the Colorado School of Mines, at the University of California and at Leland Stanford University. His earliest work with the City of Los Angeles was in connection with the Owen's River Aqueduct. In 1928 he was made Engineer of Water Works and placed in charge of construction, maintenance and operations of the Los Angeles Water Works System within the corporate limits of the city. In this capacity he is chief assistant to H. A. Van Norman, Chief Engineer and General Manager of the Bureau of Water Works and Supply.

Mr. Hurlbut is a member of the American Society of Civil Engineers and has for many years been a member of A. W. W. A., during which time he has served as Secretary and later as Chairman of the California Section. He has been responsible in a large degree for the rapid growth of this Section. Since 1933 he has served on the Board of Directors of A. W. W. A. as California's representative. At the 1935 National Convention in Cincinnati he was elected Chairman of the Plant Management and Operation Division and now steps to the highest position in the Association. For three years he fought to get a National Convention for Los Angeles and California.

N. Y. SECTION A. W. W. A.

Hears About Water Requirement in Air Conditioning

W. F. Luby
Chairman

BEFORE the half-day Winter Meeting of the New York Section of the American Water Works Association, in New York City, the following papers were presented.

Earl Devendorf, State PWA Consultant on Sanitation, and Principal Assistant Engineer, State Department of Health, presented a review covering "Water Works Construction in New York State With Federal Aid." Between 1931 and July 1935 the summary indicated that 538 projects, involving complete new water works or betterments involving construction had been completed or put under way at a total expenditure of $10,244,000. In 1935 PWA and WPA programs 10 million dollars had been allocated to water works projects alone but only 2 million had so far been spent.

"The Ground Water Supply of Long Island and Its Future" was the subject of an illustrated talk and discussion by W. W. BRUSH, Editor of "Water Works Engineering" and formerly Chief Engineer of New York's Department of Water Supply.

Mr. Brush reviewed the history of ground water supply developments in the Western end of the island since their beginning in the year 1880 and up to the present time. In recent years, salt-water incursions had indicated that a point of hazardous depletion of the fresh water reserves had been reached and the State Water Power and Control Commission had taken a hand in controlling future developments. An interesting disclosure was, that legally all prior claims to ground waters lay with the owners of the lands above, in case such water was desired for application to the land. This meant that water companies and/or municipalities drawing water for sale were considered to be trespassing and had no legal rights should the heavy draughts on wells, by one or the other, prove to be damaging to its competitor or neighbor.

Reports of prominent engineers making studies of the Long Island situation had shown an ever increasing encroachment of salt-water and a lowering of the static ground-water level at the rate of 15 inches per year. Their conclusion was that even with 50 per cent of the 42 inch average rainfall a yield of 1 to 1.25 m.g.d. per square mile of absorptive area could be taken without serious depletion of fresh-water storage within the ground reservoir. Evenso; applications, denials and repeated appeals therefrom, by New York City, to the Water Control Commission, for rights to operate its newest Layne type wells (put down to yield 11.5 m.g.d.) as an emergency or temporary source, had been repeatedly denied. The Commission held that the wells had been put down without the requisite permit and, in consequence, the $400,000 invested was yielding nothing, whereas, applications by private water companies had been approved in the interim. On the other hand, the Water Control Commission had ruled that in all new well developments for industrial usage the water taken out of the ground had to be returned thereto essentially in toto and without undue impairment of quality.

"Air Conditioning in Relation to Water Consumption" was dealt with in a well presented illustrated talk by L. L. LEWIS, Chief Engineer, Carrier Corp., Newark, N. J., in which he reviewed the progress made with air conditioning during its 30 years of utilization and probable effect that its growing popularization would have on water consumption in the future.

Mr. Lewis explained that air conditioning had formerly involved the use of considerable water, without attempts at its re-use. This had become a record which had created the alarm sounded in the water supply field and fears of many that air conditioning would put severe strains on the water works utility, if not dangerously deplete the supply. He said that manufacturers of air conditioning and refrigeration equipment had long since been faced with high water costs and this had brought about conservation of water by necessity, in order to reduce sales resistance to a minimum. Modern systems, operating on purchased water, therefore, now incorporated re-circulation and air-cooling to the maximum degree possible. Thus had water consumption been reduced to that requisite for evaporation replacement and possible leakage—roughly a 90 per cent average reduction.

Looking at the future, for the next 15 years or so, the Carrier Corporation contemplated that sales of air conditioning equipment would double every 4th year and it would be necessary, therefore, to squarely face the facts. The question of increased water consumption was a hot-weather problem and information collected to date indicated that the following water demands existed, the figures being gallons per hour per person served by air-conditioned quarters: Offices, 47; Residences, 40; Restaurants, 20; Department Stores, 16; Theaters, 10. With the expanded utilization of air conditioning 10 years hence, Mr. Lewis believed that 23 to 35 gals. per capita as the Summer maximum and 3 to 5 gals. as the daily average added consumption, when spread over the whole year, would be a safe prediction to assume. In some instances poorly prepared water utilities would find such an increase burdensome, if not embarrassing. On the other hand, those adequately equipped to supply the gradually increasing demand would find the additional profit from the sale of more water a desirable aspect. He assumed that at least some profit from water works operation was considered basically sound practice and the aim of water works managers. He hoped that a mutual interest and the desired cooperation, between air conditioning interests and water works authorities, might result in profit to both. His organization stood ready to supply all available information, in order that the known factors and those in the making might be applied in water supply planning.

Mr. Lewis was given a vote of appreciation for his contribution and the offer of cooperation by the Carrier Corporation.

Arrangement of Drafting Room with No-Shadow Lighting

NEW OFFICE LAYOUT FOR BLACK & VEATCH, ENGINEERS

by N. T. VEATCH, Jr.*
Kansas City, Mo.

N. T. Veatch, Jr.

BLACK & Veatch, Consulting Engineers, Kansas City, Missouri, have recently moved into new offices especially designed to meet the requirements of an engineering firm.

Their new quarters have been planned with the idea that office arrangement has a direct bearing on the cost of engineering work. The desirability of special planned offices has been impressed on this firm at frequent intervals during its twenty-six years of practice, which has involved the occupancy of space in four locations with attendant remodeling and extensions in each.

The practice of Black & Veatch comprises:

1. The preparation of plans and specifications for construction work of various kinds.
2. The preparation of reports.
3. The appraisal of utility properties and rate investigations.
4. Surveys of projected work and tests of completed projects.

These activities call for the maintenance of:

1. A drafting room.
2. A stenographic force.
3. A library.
4. A chemical and bacteriological laboratory.
5. Working space for firm principals, assistants, computers and others not provided for in the drafting room.
6. Space for conferences and for the inspection of plans by contractors.
7. Filing space for current business, and for records of completed projects.
8. Storage space for surveying instruments, recording and testing instruments and miscellaneous equipment.

The new offices occupy the second floor of the new "Plaza Hall" building at 47th and Broadway. This building is one of several two-story combined store and office buildings grouped in an attractive shopping center known as the "Country Club Plaza," which forms a part of the extensive and well known "Country Club" district of Kansas City, a development carried out by the J. C. Nichols Companies over a period of some twenty-five years. The Plaza is about four miles south of the main retail business district of Kansas City.

The new location offers a number of attractive features to a firm whose business is practically all secured away from the headquarters city. Considerable thought was given to the possible disadvantage of being away from the downtown district, but it was decided that the advantages offered by the new location far outweighed the disadvantages. The new office is easily accessible to all main highways, and is about the same distance, so far as time is concerned, from the Union Station as were the former offices. Excellent hotel accommodations are available within three blocks. All of these facts, together with the fact that a very small per cent of the firm's clients visit the office, led to the decision to move to what seemed, at first thought, to be an "out of touch" location. Most of the firm members and employees live in the southerly part of the city, and these individuals benefit by a saving of approximately one-half hour per day in time required to travel to and from homes. Another asset is that ample free parking space is provided adjacent to the office. The relative freedom from dust, smoke and noise is quite gratifying. Branches of the Post Office, telegraph and express companies are conveniently located.

Office Plan

The plan of the office layout was adopted after considerable study on the part of the architects and members of the firm—see cut.

The entrance lobby and space for the stenographic force is provided in an open central rectangular space adjacent to the front entrance to the offices. Grouped around this space are the offices of the principal assistants, a conference room which may be used by contractors when examining plans, and a room set aside for computing and calculating operations; used primarily in appraisal work. The live files and mimeograph equipment are kept in a room at the rear of the stenographic space, and dead file storage is provided on the third floor space along the east wing.

The offices of the firm members, the office engineer, the laboratory and drafting room are located in the

*Note.—Being impressed with the arrangements of the specially designed offices of Black and Veatch, Engineers, Mr. Veatch (firm member) was requested by WATER WORKS AND SEWERAGE to contribute this description.—*Ed.*

north wing, and are isolated from the remainder of the office. In the drafting room, in addition to the drafting tables, are files for current plans, a trimming and binding table, and a desk used for print storage, designing and computing.

With the arrangement thus provided, various individuals, whose duties are allied, are grouped as closely as possible. And, callers, wishing to see any individual, can be directed to that person with a minimum of distraction to others.

The main library, comprising technical books of general interest, bound engineering magazines, bound society publications and reports, is grouped in sectional book cases in the halls. In addition, each private office is equipped with book cases for books and publications relating to the particular field of work in which that office occupant is mainly concerned.

Telephone connection to the offices is made through two trunk lines leading to a switchboard. Each private office and the drafting room is equipped with an instrument, and provision is made whereby these instruments may be used for inter-office communication as well as for calling outside. The system is automatic to the extent that the switchboard operator need only handle calls coming in from the outside.

Lighting Given Especial Study

The matter of lighting was considered to be of primary importance and considerable thought and study was devoted to the solution of that problem. The lighting system adopted is the type known as the indirect system, and it is so designed and arranged that the drafting room, and stenographic office, are supplied with 35 to 40 foot candle illumination, uniformly distributed over all drafting tables, and desks. The private offices have 15 to 20 foot candle illumination. In both instances the light supplied is well above that which is generally considered the minimum desirable. The lighting fixtures so diffuse the light that there are no shadows and there is no necessity for the use of individual desk or table lamps, with their attendant glare. In connection with the study relating to the selection of lighting fixtures, careful thought was given to the color of paint to be used on all interiors. Light colors were adopted for this work so that the maximum efficiency could be obtained from all diffused light. Most of the partitions between the private offices are wood paneled wainscot height and clear glass above that point. Such construction permits a maximum use of all available daylight.

Arrangement of Private Offices and Special Rooms Around the Central Office.

Ventilating System

Three ventilating fans have been installed above the offices, and are connected through ducts to six registers set in the office ceilings. These fans are each driven by a ¾ horsepower motor, and it is possible to completely change the air in the offices several times per hour. It is expected that during hot weather these fans will make it possible to draw cool air into the building at night, thereby cooling the interior of the offices and maintaining a lower average temperature during the day. The ventilating system has the added advantage of providing fresh air at all times throughout the year, a condition making for more efficient work with less fatigue on the part of the office workers.

Photographs of the main office and drafting room are shown herewith. Particular attention is called to the uniformity of light diffusion in the drafting room. The fixtures show no glare and the border of light around the walls at the ceiling is almost a straight line.

Storage for instruments and equipment is provided in a concrete vault in the basement of a nearby building.

The design for the office layout was prepared by the J. C. Nichols Company under the direction of E. W. Tanner, Chief Architect.

▼

Association Meetings Scheduled

Feb. 14—**South Jersey Association of Water Superintendents.** Moorestown, N. J. Sec'y, Walter Spencer, 2707 Bethel Ave., Merchantsville, N. J.

Feb. 20—**New England Water Works Association.** Hotel Statler, Boston, Mass. Sec'y Frank J. Gifford, Room 613, Statler Bldg., Boston, Mass.

March 23-25—**Kentucky-Tennessee Section.** Lexington, Ky. Sec'y, F. C. Dugan, State Board of Health, 532 W. Main St., Louisville, Ky.

March 26-27—**New York Section, A.W.W.A.** Oswego, N. Y. Secretary, R. K. Blanchard, Neptune Meter Co., 50 W. 50th St., New York, N. Y.

March 31-April 2—**Florida Section, A.W.W.A.** Tampa, Fla., Secretary, J. R. Hoy, Hilderbrandt Bldg., Jacksonville, Fla.

April 1-3—**Canadian Section, A.W.W.A.** Royal Connaught Hotel, Hamilton, Ont., Secretary-Treasurer, A. E. Berry, Ontario Department of Health, Parliament Buildings, Toronto, Ont.

April 2-3—**Michigan Sewage Works Ass'n.** Michigan State College, East Lansing, Mich. Secretary, W. F. Shephard, State Dept. of Health, Lansing, Mich. (Sewage Works Operators' 3 day Short School (March 30-April 1) precedes Conference.)

April 7-9—**Southeastern Section A.W.W.A.** Hotel De Sota, Savannah, Ga. Secretary, W. H. Weir, State Board of Health, 135 State Capitol Building, Atlanta, Ga.

April 8—**New Jersey Water Works Association.** Trenton, N. J. Secretary, William C. Flanders, 916 Lake St., Newark, N. J.

April 7-9—**Indiana Section, A.W.W.A.** Purdue University, Lafayette, Ind. Secretary-Treasurer, John A. Bruhn, Indianapolis Water Company, Indianapolis, Ind.

April 9-10—**Illinois Section, A.W.W.A.** Evanston, Ill., Secretary-Treasurer, W. D. Gerber, 811 W. Oregon St., Urbana, Ill.

April 17-18—**Montana Section,** Butte, Mont. Secretary, H. B. Foote, State Board of Health, Helena, Mont. (Operators' Short School—April 15-16.)

April 27—**New England Sewage Works Association.** Hartford, Conn. Secretary, F. W. Gilcreas, State Department of Health, New Scotland Avenue, Albany, N. Y.

May 14-15—**Maryland-Delaware Water and Sewage Works Ass'n.** Francis Scott Key Hotel, Frederick, Md., Secretary-Treasurer, A. W. Blohm, State Dept. of Health, Baltimore, Md.

June 8-12—**American Water Works Association.** (Annual Convention.) Biltmore Hotel, Los Angeles, Calif. Secretary, B. C. Little, 29 West 39th St., New York City.

EVALUATING EFFICIENCY IN THE PURCHASE OE PUMPING EQUIPMENT

By A. M. BRENNEKE

City Engr. and Supt. of Utilities, Denison, Texas

The Author

BRIEFLY stated, the value of efficiency in any pumping equipment is the monetary saving which will accrue to the owner throughout the life of a pump, due to the more effective use of power purchased or power generated to drive the pump.

Let us look into the horizontal centrifugal pump, direct connected to an electric motor. We will assume that current is being purchased from some utility company. Depending upon its location and the size of the city, electric power can be purchased through most companies at various rates, from about 7 mills to 3 cents per kilowatt hour. We will assume that its cost is 1 cent per kilowatt hour, as this is a fair average except in very small towns.

Centrifugal pumps have been developed to the point where efficiencies now range up to as high as 90 per cent in the larger sizes. If a user purchased a pump with an efficiency of less than 70 per cent it would prove more costly during the life of the pump than would be the case when purchasing a more costly pump with an efficiency of 80 per cent or better. This statement is based on the assumption that the pump operates as much as ten hours daily on the average.

The Method of Comparison

Assume a 2,000 gallon per minute pump against a head of 250 feet. The pump is direct connected to an electric motor, for which current is purchased at 1 cent per kilowatt hour. This pump station is some distance from town, and the power line loss is 5 per cent. Motor efficiency will be assumed at 95 per cent. Under these conditions, the work done in pumping water is $\frac{2000 \times 8.33 \times 250}{33{,}000}$ which equals 126 horse power of actual work. With a pumping unit 70 per cent efficient $\left(\frac{126}{70}\right)$ or 181 h.p. must be transmitted to the pump. With a motor 95 per cent efficient $\left(\frac{181}{95}\right)$ or 190 h.p. must be the motor input. With a 5 per cent line loss $\left(\frac{190}{95}\right)$ or 200 h.p. must be purchased to secure 126 h.p. of work done. This takes 200 x .7457 or 149 k.w. If this pump operates 20 hours per day, in one year it would use (149 x 20 x 30 x 12), or 1,072,800 k.w.h., which at 1 cent gives an annual power cost of $10,728.

Were this pump a unit 80 per cent efficient $\left(\frac{126}{80}\right)$ or 158 h.p. has to be transmitted to the pump. With the same 95 per cent efficient motor $\left(\frac{158}{95}\right)$ or 166 h.p. must be the motor input. With the same 5 per cent line loss $\left(\frac{166}{95}\right)$ or 175 h.p. purchased to secure 126 h.p. of work done. This takes 175 x .7457 or 130.5 k.w. Operating 20 hours per day, in one year it would use (130.5 x 20 x 30 x 12), or 939,600 k.w.h., which at 1 cent gives an annual power cost of $9,396.

The first cost between two or more pumps under consideration is, of course, an important item, but when one spends for power, during the life of a pump, about twice as much per year as the pump costs, then the matter of relative operating cost is of infinitely more importance than the matter of first cost, and should be given more consideration.

Carrying our calculations a step farther, let us assume that the 70 per cent efficient pumping unit costs $4,000 installed, and the 80 per cent efficient pumping unit costs $5,000 installed. If this pump lasts for ten years, then its total cost over a ten-year period, under these conditions, would be as follows:

	70% Efficient Pump	80% Efficient Pump
Original Investment Cost	$ 4,000	$ 5,000
5% Interest on Investment	2,000	2,500
Power Costs	107,280	93,960
75% Depreciation	3,000	3,750
Total 10-year Cost	$116,280	$105,210

The items of obsolescence and pump repairs have not been taken into consideration in the above tabulation, for the reason that they would be so indefinite in either case that they would have little if any value that would affect the final comparative results.

In view of pump developments in the last ten years, the item of obsolescence will probably work a greater disadvantage to the least efficient pump than to the more efficient pump. In this argument for the use of the more efficient pumps, we err on the conservative side, if at all, when we eliminate the factor of obsolescence.

As regards pump repairs, any difference in cost as between the two pumps over a period of years would likely be controlled more by the design of the particular pumps in question than by their relative efficiencies, for if the water contains sand, a highly efficient pump can be cut out as easily and as quickly as a less efficient pump, unless the material used in the more expensive pump is more resistant to abrasion.

From the foregoing tabulations of total costs of the two pumps in question, it is seen that an additional investment of $1,000 in the purchase of a pump with just 10 per cent higher efficiency will save the purchaser something over $11,000 in ten years. The return of $1,100 annually on an original additional investment of $1,000 would appear to be a sound investment. This is the value of efficiency in the operation of pumping equipment.

EDITORIAL

On Having Courage to Fight

IN A RECENT ISSUE of Pennsylvania Water Works Association's monthly "News Letter," John H. Murdoch, Jr., president of the association, presents an editorial calling upon managers of privately owned water works systems to "call a halt" in the matter of conceding to crippling demands by municipal governments for ever-increasing reductions in fire protection charges, and domestic water rates.

Mr. Murdoch's plea to water company officials is worthy of re-stating, for the benefit of those who may not have seen the original. In fact, the re-reading of it will also be worth while to those who have seen the original; and, likewise, its context should prove thought provoking when it meets the eyes of superintendents and managers of municipally owned systems.

Because, states Mr. Murdoch, local governmental officials are hesitant about taking the unpopular step of forcing payments of taxes, many municipalities needful of cash for general finances take a presumedly popular stand in demanding that fire protection rates must be reduced. Briefly, it amounts to this: In order that some city officials might continue to draw salaries, without making themselves unpopular by inconveniencing taxpayers, who happen be voters, attempts have been made to squeeze out of the water utility a contribution to the city treasury by these nothing short of chiseling methods. At the same time, however, demands for improvements in water service to meet higher and higher standards are constantly being pressed. Along with all of this also come demands for reduced rates for domestic consumers, backed by the popular clamor of the public.

The easy road to peace locally, if not also with regulatory commissions, is to grant first one concession and then another. But, in the genuine interest of the public as well as the utility, water works managers must sometimes refuse to buy popularity at the cost of the unjust prices which are demanded.

Water utilities, states Mr. Murdoch, do not in reality sell the commodity—water. It is primarily the sale of a service which requires careful management and, too, the largest capital investment carried, per dollar of revenue, of any of the public utilities. Furthermore, on the thought and care given their operations depends the health and safety of our communities. It is contrary, therefore, to the public interest to so curtail payments for that service which are likely to force retrenchments in operation and maintenance, or needed new facilities.

In respect to water companies, Mr. Murdoch points out that, lest we forget, such companies were established for the most part to render a needed service at a time when public officials were unwilling to take the risks of investing public funds in schemes for supplying pure and wholesome water as a public enterprise. They considered it a speculative enterprise and not a municipal function. Having taken all of the risks and having performed a public service, why should well established water companies be reticent or show intimidation when the time arrives to justifiably insist that they be allowed earnings sufficient to continue good—not makeshift—service. Public welfare is with certainty a consideration which should demand good service in opposition to a pinch-penny attitude and lack of comprehension or appreciation, if not deliberate unfairness, on the part of some public officials.

It is hoped that water company managers and municipal water department superintendents will always find the courage to resist attempts to make the welfare of the citizens of their communities subordinate to a cheap popularity. Does not Mr. Murdoch's plea to water companies to fight for rates productive of an income sufficient to cover the cost of maintaining efficient service and a safe supply of water, apply to every water utility manager—no matter whether public or private. The fact is that income to many municipally owned water works is too frequently at the mercy of political office holders and many plants have been limping along in recent years because of curtailed budgets. Is not now the time for superintendents to find the justified courage to insist on a more adequate budget, a revamping of the system, replacement of obsolescent equipment; and, not least, commensurate salaries. And, with it all, water rates and fire service charges sufficient to pay the cost of providing and insuring a dependable service from the most important of the public utilities.

▼

Good "Boon-Doggling"

EDWARD NEUBLING, engineer in charge of water supply control Department of Water Supply of New York City, reports that a WPA project, which put men to work inspecting for leaks in household fixtures and services, has been a highly profitable relief project.

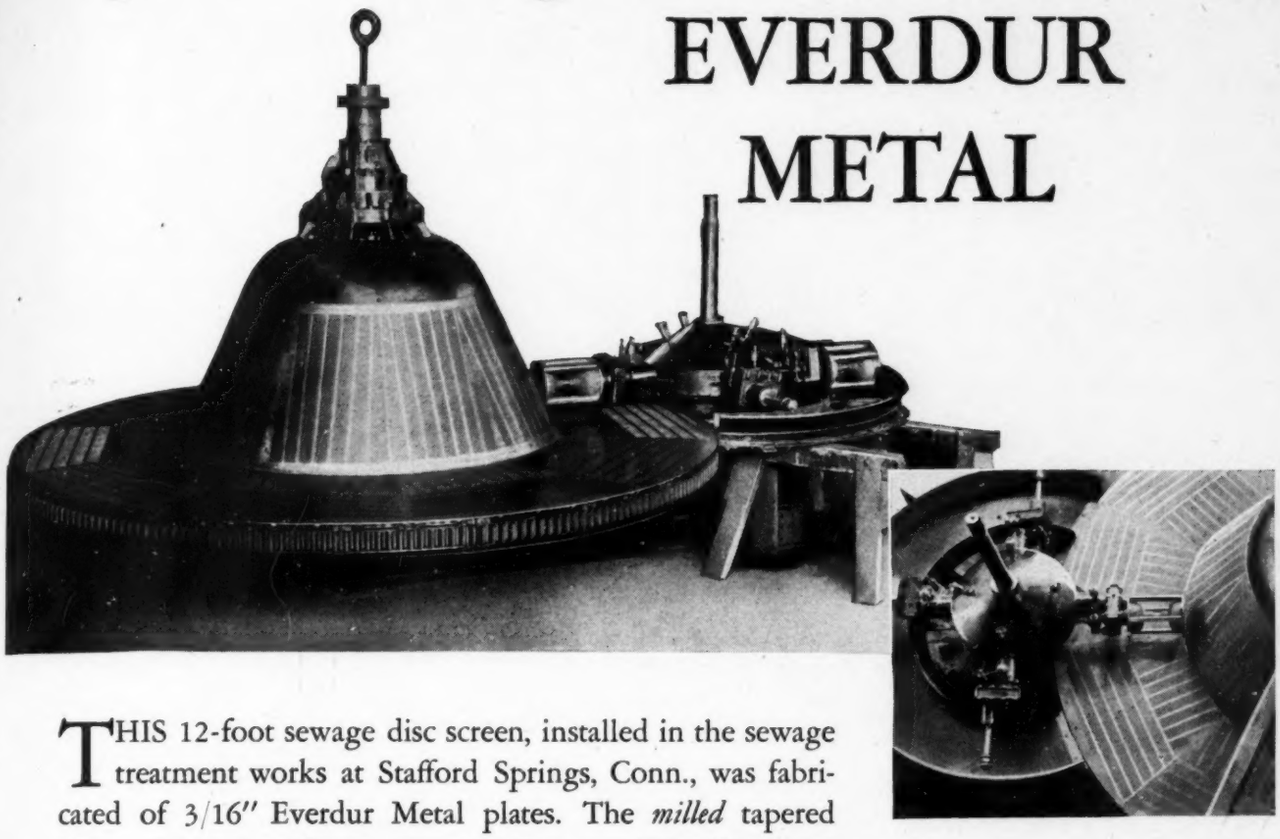
Since the inauguration of this WPA leakage survey project in the spring of 1935 water consumption, due largely to wasting water, has been reported to have been reduced by roughly 40,000,000 gals. daily. Already more than 300,000 leaking fixtures or services have been located and about half of this number have been repaired by the owners.

No "Boon-doggling" here! Such a project serves as a highly valuable means of putting WPA relief money to effective use, and the so-called "white collar" unemployed to productive service.

Another survey has been organized, also as a WPA project, to study and check up on the various items on which New York City's flat rates are based. This may result in a revision of the present methods employed in billing the tremendous unmetered population of New York City for water service. Further than this, the survey will supply concrete information concerning the practicability of metering and the real, as against the hypothetical, benefit to be anticipated from a wider application of metering domestic services in New York City.

Leakage surveys have been conducted in both large and small municipalities as WPA or other relief agency projects. And, always with the same results—money saved the water utility and sewer department by cutting down water waste through mains and services. This is a type of WPA project that but few communities will find wasteful. Surely this is a worth while bit of relief "Boon-doggling" of a profitable nature and widespread in application. Mr. Superintendent: Could you use some of this sort of "Boon-doggling" in your town?

12-foot Sewage Disc Screen of EVERDUR METAL



Shop assembly views of 12-foot Everdur sewage disc screen with revolving brush mechanism (brush staves not shown). Designed and furnished by Krajewski-Pesant Mfg. Corp., New York City, for the Stafford Springs, Conn., Sewage Treatment Works.

THIS 12-foot sewage disc screen, installed in the sewage treatment works at Stafford Springs, Conn., was fabricated of 3/16″ Everdur Metal plates. The *milled* tapered slots, 43,000 in all, measure 1/32″ x 2 1/2″. All screen segments were fastened to the framework with Everdur flat head screws, lockwashers and nuts.

The disc screen is installed on an incline and rotates, subjecting the Everdur screen plates to alternating submersion in highly corrosive sewage water. The revolving brush mechanism cleans the sewage screenings above the high water level.

The excellent corrosion resistance of Everdur, and its general ease of fabrication, have led to its extensive acceptance in the water works and sewage treatment fields. This moderately priced Anaconda alloy, with the strength and weldability of medium carbon steel, makes possible important savings in weight, plus unusual fabricating economies. Additional information on Everdur will be gladly supplied on request.

35272

EVERDUR METAL

"Everdur" is a registered trade-mark identifying products of The American Brass Company made from alloys of copper, silicon and other elements.

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from mine to consumer

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EQUIPMENT NEWS AND LITERATURE REVIEW

Crane Solder Joint Valve

For some time Crane Company of Chicago, Ill., has been supplying solder joint fittings for small pipes in a wide range of sizes. Recently Solder Joint Valves have been added to the Crane line. In this new design globe, angle, check and gate valves

Crane Solder Joint Valve

are available. The ends are accurately machined for use with copper tubing, the valves being designed in accordance with the "Streamline" patents held by Mueller Brass Company. All parts of this new line of valves are interchangeable with those of Crane standard screw end valves.

For descriptive literature address—Crane Company, 836 So. Michigan Ave., Chicago, Illinois.

▼

Portable Testing Tank for Water Meters

To fill demands for an inexpensive but accurate means of testing water meters, the Ford Meter Box Company of Wabash, Ind., have recently developed their new Portable Calibrated Meter Testing Tank. Especially was this low priced meter-shop unit developed for the smaller municipalities which have heretofore used meter test methods other than the positive volume-weight method prescribed by state regulatory bodies. The new unit meets all legal requirements in meter testing practice.

Testing of meters and efficient maintenance have come to be considered one of the simplest and quickest methods of raising the revenues of water-departments. To insure maximum return and minimum complaint, accuracy in testing is the important essential. Shop equipment cost has stood in the way of greater water works income from meters in many cases; and, it is this theory which has prompted the manufacturers to offer the small but automatically accurate test unit. For testing at the customer's service this readily portable unit is especially worthy because its peculiar design insures accuracy even when not setting perfectly level.

For the reason why, and other illustrated descriptive details, address—Ford Meter Box Co., Wabash, Indiana.

New Portable Calibrated Meter Testing Tank

▼

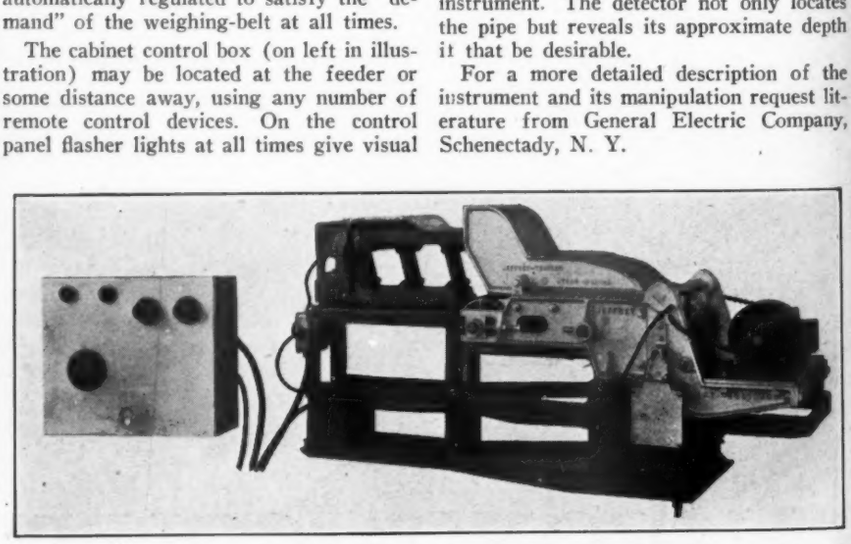
Jeffrey Traylor

A new constant-weight feeder, for continuously feeding and weighing materials at accurate rates, has been announced by the Jeffrey Manufacturing Company of Columbus, Ohio. It consists of a vibrating feeder, the output of which is controlled electrically by a balanced weighing-belt equipped with an adjustable counterpoise for controlling the desired rate of discharge in weight rather than volume. All gates for regulating the flow of material are eliminated and great weighing accuracy is obtained by virtue of the marked sensitiveness of the scale. Through its electrical control the vibrating feeder is automatically regulated to satisfy the "demand" of the weighing-belt at all times.

The cabinet control box (on left in illustration) may be located at the feeder or some distance away, using any number of remote control devices. On the control panel flasher lights at all times give visual evidence of correct operation. The unit operates from any A. C. light circuit.

The Jeffrey-Traylor Feeder is guaranteed accurate to within 1 per cent, and can be set to deliver with uniform accuracy any rate from minimum to maximum. The capacity range of the unit, here pictured, is 3 to 3,000 lbs. per hour. The same principle and control system is being used in units of other capacities.

For illustrated catalog and further information, address—The Jeffrey-Traylor Division of Jeffrey Mfg. Co., Columbus, Ohio.



Jeffrey-Traylor Constant-Weight Feeder

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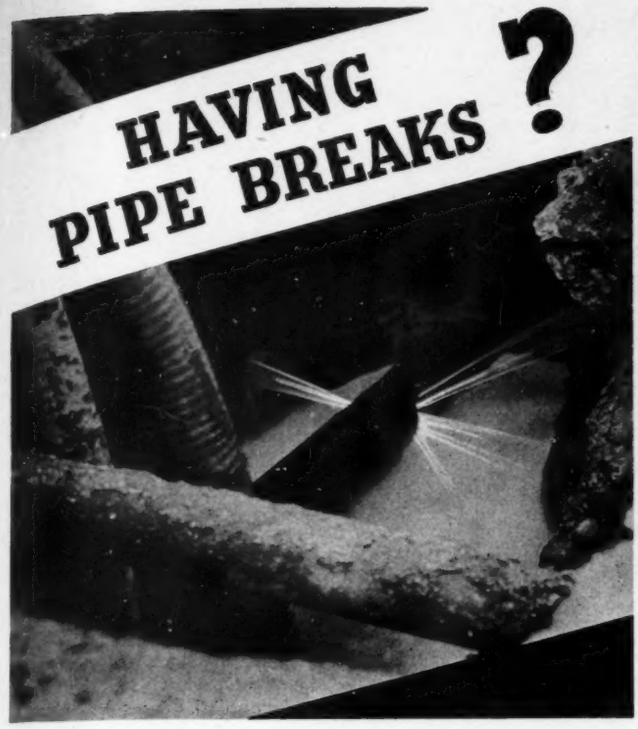
New Pipe Finder

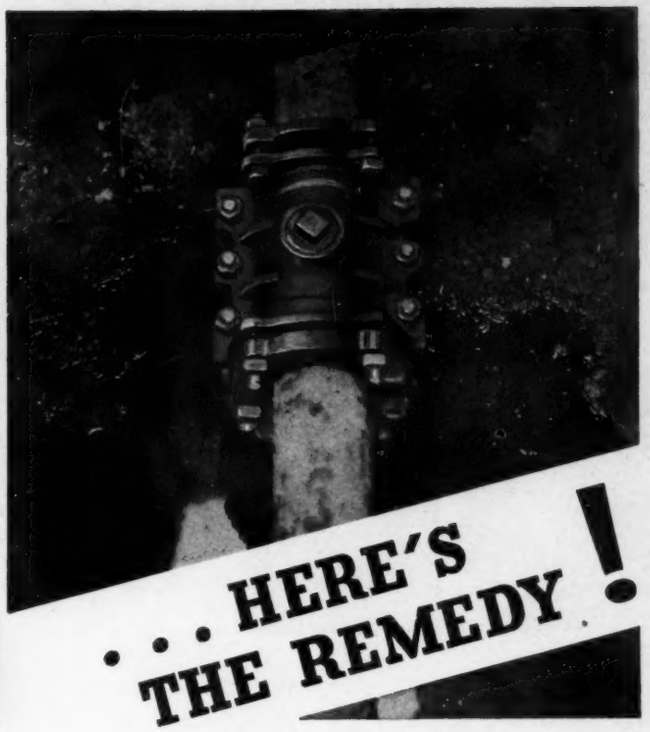
General Electric Company is offering a new magnetic type of pipe locater which is 100 times as sensitive as the ordinary magnetic needle. Essentially it is a surveying

"GE" Magnetic Pipe Finder

compass with an adjustable bar magnet for reducing control effects of the magnetic field of the earth. It also renders the needle more easily influenced by buried metallic pipes a considerable distance away from the instrument. The detector not only locates the pipe but reveals its approximate depth if that be desirable.

For a more detailed description of the instrument and its manipulation request literature from General Electric Company, Schenectady, N. Y.





Make the Repair QUICKLY! PERMANENTLY! —with DRESSER SPLIT SLEEVES

TOP — Dresser Cast Split Sleeve, Style 57. Sizes 2" to 12" inclusive. For packing off a section of cast-iron pipe 8" long.

CENTER—Multiple installations of Style 57 can be adapted for almost any length of break.

BOTTOM — Don't forget Dresser Cast Split Sleeves, Style 26 (sizes 3" to 24" inclusive) for enclosing broken bells.

No need to let a break, like the one shown above, cripple or interrupt your service. Ordinary workmen can make the repair easily, positively, and permanently—in a very *few minutes!* Just give them a Dresser Style 57 Split Sleeve to enclose the break, and a wrench to tighten the bolts.

The Dresser *rubber pack* makes an instantly effective and lasting seal; it also provides the continuous flexibility needed at the point where the pipe failed. Put the Style 57 on and *leave* it on—for good!

You can avoid unnecessary service interruptions this winter—and the high cost of makeshift repairs—by ordering and *having on hand* Dresser Cast Split Sleeves, Style 57, for each size of cast-iron pipe in your system. Then you'll be ready for every emergency! Write for Folder No. 57.

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In Canada: Dresser Mfg. Company, Ltd., 32 Front St., W., Toronto, Ont.

KEEP A DRESSER SLEEVE ON HAND FOR QUICK REPAIRS

WITH THE MANUFACTURERS

Cutler-Hammer Announces Two Promotions

Cutler-Hammer, Inc., manufacturers of electric control apparatus, Milwaukee, announces the advancement of G. S. Crane, Sales Manager, and W. C. Stevens, Chief Engineer, to Vice-Presidencies in charge of sales and engineering, respectively.

Mr. Crane, who began his service in the engineering department more than 25 years

G. S. Crane *W. C. Stevens*

ago, for the past 12 years has been Sales Manager of the company.

Mr. Stevens came to the engineering department 30 years ago and for the past several years has served as Chief Engineer of Cutler-Hammer.

▼

R. H. Gardner Now Sales Manager Byers' Steel Pipe Div.

R. H. Gardner, formerly division manager of the Washington office, A. M. Byers Company, has been transferred to Pittsburgh as Manager of Steel Pipe Sales. This announcement was recently made by M. J. Czarniecki, Vice President of the company.

E. L. MacWhorter, formerly manager of the company's Philadelphia division, has moved to the Munsey Bldg. in Washington, where he will head the combined activities of both divisions now known as the Washington Division. The Philadelphia office is being maintained.

▼

Link Belt's Torrence Made V. P. of Illinois Manufacturers

Geo. P. Torrence

At a recent meeting, the Illinois Manufacturers' Association elected General Thomas S. Hammond, President, Whiting Corporation, as president of the association. To succeed General Hammond, George P. Torrence, President, Link-Belt Company, was elected First Vice President. C. B. Heacock, President, Caterpillar Tractor Company, was named Second Vice President.

CATALOGS AND TRADE LITERATURE RECEIVED

[Any of the publications reviewed in this column can be secured from or through Water Works & Sewerage, if such is preferable.]

"Steel Pipe—A Hand Book":—Under the unpretentious title "Bulletin 21—National Steel Pipe" comes a veritable "Hand-Book" containing 68 pages of valuable information pertaining to the mechanical features of steel pipes and various joints, water mains, construction, the corrosion problem and hydraulics of water mains, with particular reference to steel pipe and fittings. The Technical Section (40 odd pages) contains up to date discussion, formulae, tables and conversion charts on the topics of Properties of Water, Water Pressures, Flow of Water, Frictional Loss of Head, Methods of Flow Measurements, Water Power Factors, and Water Hammer. Three pages of general conversion charts and tables complete the Technical Section. Then follows a few pages devoted to Physical Properties, Weights, Dimensions and Specifications covering the several types of National Steel Pipes. Bulletin 21, in a modern spiral binder, completely indexed and typographically excellent, makes a pleasant-to-use publication. It is worthy of any technical library. Copies may be had, without charge, by addressing—National Tube Company (Publicity Department) Pittsburgh, Pa.

"Flame Traps":—Is the title of a 15 page illustrated bulletin recently issued by Pacific Flush Tank Company, designers and producers of sewage treatment equipment, exclusively, since 1893. Attractive in make-up, this bulletin in three colors illustrates and describes the three distinctive types of P. F. T. Flame Traps and their applications in gas explosion prevention. For the small installations, Type "A" Water Sealed Traps are offered; for the larger works the newer Type "B" Positive-Acting Waterless Traps are offered. An added improvement is the combination unit consisting of the rugged Type "B" trap equipped with a pressure relief gas wasting valve for pressure control. Also in this bulletin P. F. T. Waste Gas Burners, Drip Traps, Pressure Indicating Gages, and other P. F. T. equipment, are described and illustrated. With flow charts and layout plans the bulletin becomes a handy reference for designing engineers and managers of sewage works. For a copy of P. F. T. Bulletin No. 121, address—Pacific Flush Tank Company, 4241 Ravenswood Ave., Chicago, Ill.

"Cast Iron Pipe News":—The January 1936 issue of the quarterly magazine, "Cast Iron Pipe News," published by the Cast Iron Pipe Research Association, deserves comment. In it is a comprehensive article describing "The Sewer Rental System of Ohio," how it works, and why. Also is described, "The unique Sewage Treatment Works of Sioux Falls, S. D.," and the "Advantages of the Two-Main Water Distribution System" are set forth and illustrated. "On the Job With the Camera,"—an interesting collection of photographs—is as usual, interesting and instructive. If you do not receive *"Cast Iron Pipe News"* regularly it is worth writing for. Address,—Thos. F. Wolfe, Research Engineer, C. I. Pipe Research Ass'n., Peoples Gas Building, Chicago, Ill.

"ALFRAX" Laboratory Ware:—A 23 page catalog describing and illustrating Carborundum Company's line of refractory laboratory ware, which embraces crucibles, dishes, tubes, small diffusers, and the like. Production of "ALFRAX" ware, made of practically pure white oxide of aluminum (99.5 per cent Al_2O_3), is described from the mining of the bauxite ore to the finished products which are described and pictured. Every laboratory should have a copy of Catalog No. 16. Address—Carborundum Company, Niagara Falls, New York.

"Omega Gravametric Feeders": — Is the title of a bulletin which describes and illustrates the new Omega Chemical Feeder that delivers chemicals by exact weight and therefore is more accurate than volumetric feeders; requires no calibration or checking orifice settings each time the weight per cubic foot of the material being fed changes. Accompanying this bulletin is a separate leaflet containing a set of specifications for the guidance of engineers and purchasers of chemical feeding equipment; also a list of recent installations of the improved feeder. Address — Omega Machine Co., 602 Westport Avenue, Kansas City, Mo.

"Victor-Acme Rotary Blowers":—A new bulletin bearing this title comes from Roots-Connersville Blower Corporation. It describes several types of blowers and accessories. A diagram on the cover page illustrates power economics with various methods of driving blowers to deliver varying volumes of air. Other operating characteristics such as, known controlled volumes, positive air movement, freedom from internal seal or lubricant, etc., are set forth. Also, a table gives net capacities of the several units at listed speeds and pressures. Request:—Bulletin 21-B-17. Address—Roots-Connersville Blower Corporation, Connersville, Indiana.

"Long-life":—In a folder under this title, Flexrock Company of Philadelphia describe their specially prepared heavy emulsion of pure plastic asphalt which is used in roof repairs or replacements, for laying tough acid-proof floors, caulking cracks and leaks, general patch work and miscellaneous uses as a protective coating. Claims: Non-running at 300° F.; plastic at 50° below Zero. The adaptation of "Flexrock" Fabric with "Long-life" for roof building is illustrated. The manufacturer offers a liberal trial consignment of "Long-Life" at no cost. Address—Flexrock Company, 800 No. Delaware Avenue, Philadelphia, Pa.

Today's Trend In Sewage Treatment ..*is toward*

FERRIC CHLORIDE

(ANHYDROUS AND LIQUID)

Many Municipalities are Finding that Chemical Precipitation with Ferric Chloride is a Process which is:

Easily controlled and suitable for practically every type of sewage
Very flexible as regards the degree of treatment
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Independent of weather conditions
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That's why today's trend in sewage treatment is chemical precipitation in conjunction with sludge dewatering on vacuum filters with Ferric Chloride as the precipitating and conditioning agent.

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Anhydrous Ferric Chloride comes in powder form. It is packed in air-tight, non-returnable steel drums... Is readily soluble . . . And can be stored indefinitely without deterioration or liquefaction.

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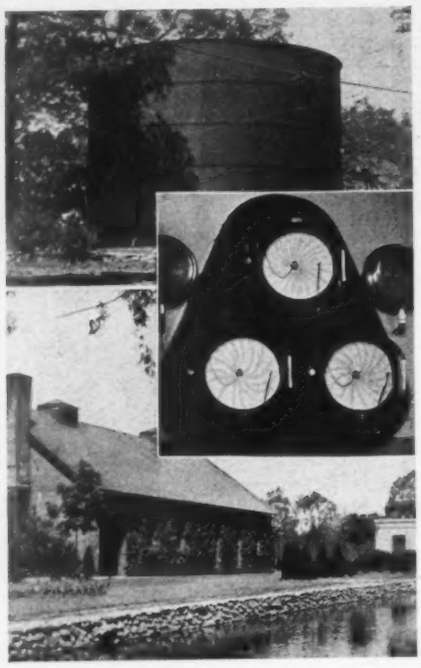

Chronoflo brings in levels of 3 tanks at Ridgewood, N. J.

The illustrations show:

1. Glen Ave. Storage Tank 1½ miles away (the other tanks are ¼-mile and 2 miles away);
2. Chronoflo Level Recorders on Station Panel; and
3. Midland Park Pumping Station.

Nobody walks a step or climbs a tank! With these Chronoflo Recorders right in front of him the Engineer knows just how much water there is in each tank; and pumps accordingly.

Would Chronoflo be useful in your plant telemetering levels, flows; pressures, or other information from distant or nearby points to the place or places where that information can help most in improving operating efficiency?

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as month by month he shows views of interesting installations.

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Bulletin 260 — Venturi Meters for Main Pipe Lines
Bulletin 232 — Venturi Direct Acting Controllers

Bulletin 273—Chronoflo Telemetering System, transmitting flow, pressure, or level measurements for "hundreds of feet or hundreds of miles."

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From 4" to 54"

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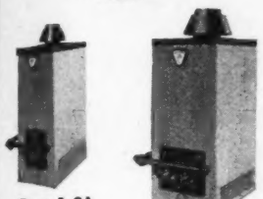
IDEAL GAS BOILER CAPACITY WITH SEWAGE DISPOSAL GAS

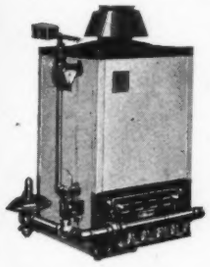
BOILER NO.		OUTPUT PER HOUR			INPUT PER HR.		BOILER SPACE		
Steam	Water	B.T.U. per Hour	Sq. Ft. Steam A.G.A. Rating	Sq. Ft. Water A.G.A. Rating	B.T.U. per Hour	Cu. Ft. 700 B.T.U. Sludge Gas	Over-all Hght.	Floor Space Width Front	Floor Space Depth
.....	1-GA-4	31,500	.....	210	39,350	56	36¼"	14½"	22½"
.....	1-GA-5	42,000	.....	280	52,500	75	36¼	14½	25½
.....	1-GA-6	52,500	.....	350	65,600	94	36¼	14½	28½
.....	1-GA-7	63,000	.....	420	78,750	113	38	14½	31½
.....	2-GA-4	63,000	.....	420	78,750	113	41¼	19½	22½
.....	2-GA-5	84,000	.....	560	105,000	150	41¼	19½	25½
.....	2-GA-6	105,000	.....	700	131,200	188	41¼	19½	28½
.....	2-GA-7	126,000	.....	840	157,500	225	41¼	19½	31½
.....	4-GA-9	168,000	.....	1120	210,000	300	41½	28	38
.....	4-GA-11	210,000	.....	1400	262,500	375	41½	28	44
.....	4-GA-13	252,000	.....	1680	315,000	450	41½	28	50
0-GS-4	.....	64,800	270	.....	81,200	116	52	23¼	28
0-GS-5	.....	86,400	360	.....	108,000	154	53	23½	31
0-GS-6	.....	108,000	450	.....	135,000	193	53	23½	34
0-GS-7	.....	129,600	540	.....	162,000	232	53	23½	37
1-GS-4	1-GW-4	146,000	610	980	182,500	261	50	35*	33¾
1-GS-5	1-GW-5	186,000	775	1240	232,500	332	52½	39*	33¾
1-GS-6	1-GW-6	225,000	940	1500	281,500	402	53¼	43*	33¾
1-GS-7	1-GW-7	265,000	1105	1770	331,000	473	53¾	47*	33¾
1-GS-8	1-GW-8	305,000	1270	2030	381,000	545	54¾	51*	33¾
1-GS-9	1-GW-9	345,000	1435	2300	431,000	616	57½	55*	33¾
1-GS-10	1-GW-10	384,000	1600	2560	480,000	686	58¼	59*	33¾
1-GS-11	1-GW-11	424,000	1765	2820	530,000	757	58¾	63*	33¾
4-GS-6	4-GW-6	480,000	2000	3200	600,000	857	69	53	52
4-GS-7	4-GW-7	576,000	2400	3840	722,000	1030	69¾	58	52
4-GS-8	4-GW-8	672,000	2800	4480	840,000	1200	71¾	62	52
4-GS-9	4-GW-9	768,000	3200	5120	960,000	1372	72½	66	52
4-GS-10	4-GW-10	864,000	3600	5760	1,079,000	1543	75	70	52
4-GS-11	4-GW-11	960,000	4000	6400	1,200,000	1715	75¾	74	52
4-GS-13	4-GW-13	1,152,000	4800	7680	1,440,000	2060	69¾	85	64
4-GS-15	4-GW-15	1,344,000	5600	8960	1,680,000	2400	71¾	93	64
4-GS-17	4-GW-17	1,536,000	6400	10240	1,920,000	2740	72½	103	64
4-GS-19	4-GW-19	1,728,000	7200	11520	2,162,000	3090	75	107	64
4-GS-21	4-GW-21	1,920,000	8000	12800	2,400,000	3425	75¾	110	64
4-GS-22	4-GW-22	2,016,000	8400	13440	2,520,000	3600	71¾	136	64
4-GS-25	4-GW-25	2,304,000	9600	15360	2,880,000	4120	72½	148	64
4-GS-28	4-GW-28	2,592,000	10800	17280	3,240,000	4625	75	160	64
4-GS-31	4-GW-31	2,880,000	12000	19200	3,600,000	5145	75¾	172	64
4-GS-33	4-GW-33	3,072,000	12800	20480	3,840,000	5480	72½	186	64
4-GS-37	4-GW-37	3,456,000	14400	23040	4,320,000	6165	75	202	64
4-GS-41	4-GW-41	3,840,000	16000	25600	4,800,000	6850	75¾	218	64

1-GS shown. The 1-GW is 4" shorter.


Type 1-GA

Type 2-GA

Type 4-GA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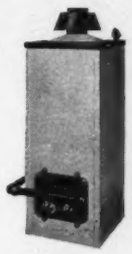
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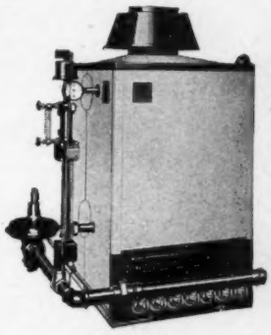
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Simplicity of Design, Accuracy, Dependability, Low Maintenance Cost, and Direct-Acting Features make SIMPLEX CONTROLLERS the selection of Designing and Operating Engineers all over the world.

YOU can better YOUR filter operation by their use.

A card will bring you complete data.

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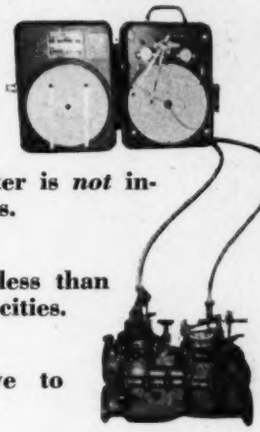
METER-MASTER

A Rate Recorder attachable to ANY water meter, single or compound.



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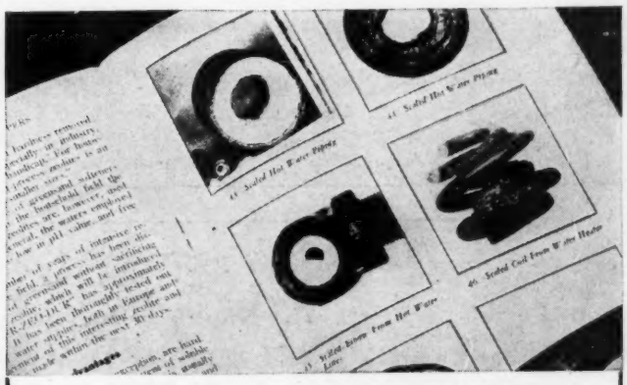

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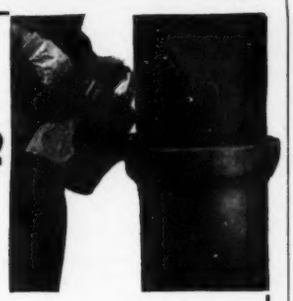

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Feb.

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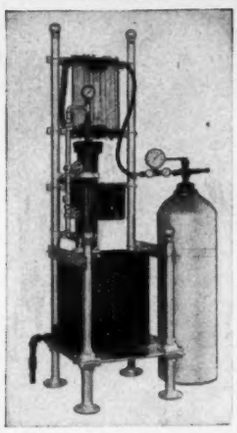

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Here at last is a reasonably priced, accurate, chlorinator that anyone can operate safely. EVERSON Model G Series Chlorinator offering for the first time: Any delivery from 1 to 100 lbs. of chlorine per 24 hours; Metered-feed; Intimate mixture of gas in water-sealed, self-venting chamber; Protection against back-flooding by an automatic vacuum break, non-corrosion line and values (Guaranteed against corrosion for 1 year) divided into standard replaceable units for safe, easy-cleaning and maintenance; Reliable equipment designed, manufactured and guaranteed by "The Swimming Pool People" specialists in water conditioning for two generations.

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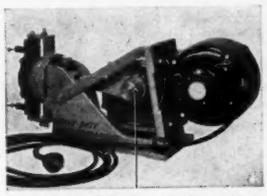

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30 YEARS Experience

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50 CHURCH ST. NEW YORK

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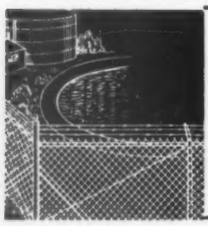

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POSITION WANTED — As superintendent filtration, chemist and bacteriologist, or operator chemist and bacteriologist, of small or medium sized plant, by young man technically educated, industrious and ambitious for plant betterment. Eleven years' experience. May I have the opportunity of communicating with you? Address J. Z. C., % Water Works & Sewerage, 400 W. Madison St., Chicago.

SANITARY ENGINEER-CHEMIST: Graduate Sanitary Engineer (M. S. degree) with eight years' experience in water works and sewerage operation; and analysis of water and sewage. Wants operating position in water works or sewerage field; preferably in Southern states. Age 30, married and now employed. Address A. U., % WATER WORKS AND SEWERAGE, 155 East 44th St., N. Y. C.

GRADUATE ENGINEER: Civil Engineer (B. S. Yale University 1933) wishes position with construction or engineering firm. Experience since 1927 includes construction of steel frame buildings, highways, cost control work, geodetic surveys. Especially interested in work in sanitary field. Age 26, married. Address "E. V. T." care WATER WORKS AND SEWERAGE, 155 East 44th Street, New York City.

Dorrco Doings in 1935

The past year has been one of great contrasts. Much progress has been made toward national recovery in this country and in many of the other countries of the world. But a growing fear of war and of a general breakdown of international relations encompasses the thoughts of men.

Our own recovery has been greatly in evidence, with a growing conviction that it has been due more to the functioning of natural laws than to the New Deal. An economist recently told me that the only logical answer to the Literary Digest questionnaire on the latter was "Yes and No".

It is evident that those companies which, adequately financed, spent the time of the depression in the development of new things are today prosperous. Those that did not are striving to exist with less business at lower margins.

Many feel as I do that the crying need today is a study of the problems of human relationships, both individually and internationally. The next great increment to the sum of human happiness is likely to come, not so much from the development of material things, as from the removal, by readjustment, of what Horace Fletcher called "Fear Thought".

LARGEST SEDIMENTATION JOB

An outstanding event of the year for our company has been the contract for desilting daily 8 billion gallons of the waters of the Colorado River, to be carried by the new All American Canal to the Imperial Valley in California. This installation of special thickeners is the fruition of six years of cooperative research and development and will result in the removal of a maximum of 70,000 tons of silt per day.

The work incident to it has materially extended the scope of our usefulness and has added to our store of knowledge in our chosen field. It has meant, too, high courage and engineering prescience on the part of those Federal officials and engineers directly responsible.

INCREASING GRINDING EFFICIENCY

Cooperative study has proved its value in metallurgical work many times. Two months of last year were spent by one of our engineers at a well known mill. The study of this six year old plant yielded means for remodeling the grinding department. As a result, an increase in capacity of 50 percent will be realized under the same roof with the same metallurgical efficiency and without additional grinding equipment.

REDUCING POWER CONSUMPTION

Demands from the sanitary engineering field have brought improvements in clarifier design. The clarifiers for the 400 million-gallon Chicago Southwest Side sewage plant are of our newest type, being more efficient and powered at about half of former practice.

AUTOMATIC OVERLOAD RELIEF

At three of our large installations a new automatic lifting device has been incorporated in the sedimentation units. This device, actuated by the torsional load imposed, raises the rakes during an overload and lowers them upon resumption of normal load without manual effort.

SEWAGE SLUDGE DIGESTION

A detailed research study into the economics of sludge digestion shows that this step can be always justified regardless of the method employed for disposing of the sludge subsequently. Many consider it one of the year's leading contributions to sanitational knowledge.

PULP & PAPER

Union Bag and Paper Company's new sulfate pulp mill at Savannah, Ga., is to have one of the most complete Dorr continuous recausticizing plants. Other chemical pulp mills that installed this system last year were Bogalusa, Southern Kraft and Chesapeake Corp.

PROCESS DEVELOPMENT

Continued recognition of the importance of fundamentals has kept our staff busy and has given us more basic knowledge on which to build. Our experience in process work and our ability to recognize what we as an organization can do and what we can't do continues to bring us new ideas from our friends.

HIGH SPECIFICATION SAND

Our experience in producing rigid specification sand at the Boulder Dam in Nevada has brought us a large order for an even bigger classification and sedimentation plant at the Grand Coulee Dam in Washington.

HEAVY DUTY CLASSIFIERS

As anticipated, our heavy duty FX Classifier continues to prove its value in the metallurgical field through making possible the economies inherent in high circulating loads.

EUROPE

The 1935 activities of our European Associates have ranged from the equipping of the Bor copper concentrator in Jugo-Slavia, which ranks with their largest projects in the continental metallurgical field, to the near completion of the Madrid sewage plant. New units were added to the complete phosphoric acid plant they built in Greece. Central Sugar in England is the first in that country to use our automatic carbonation system which has been so successful in the United States beet sugar field.

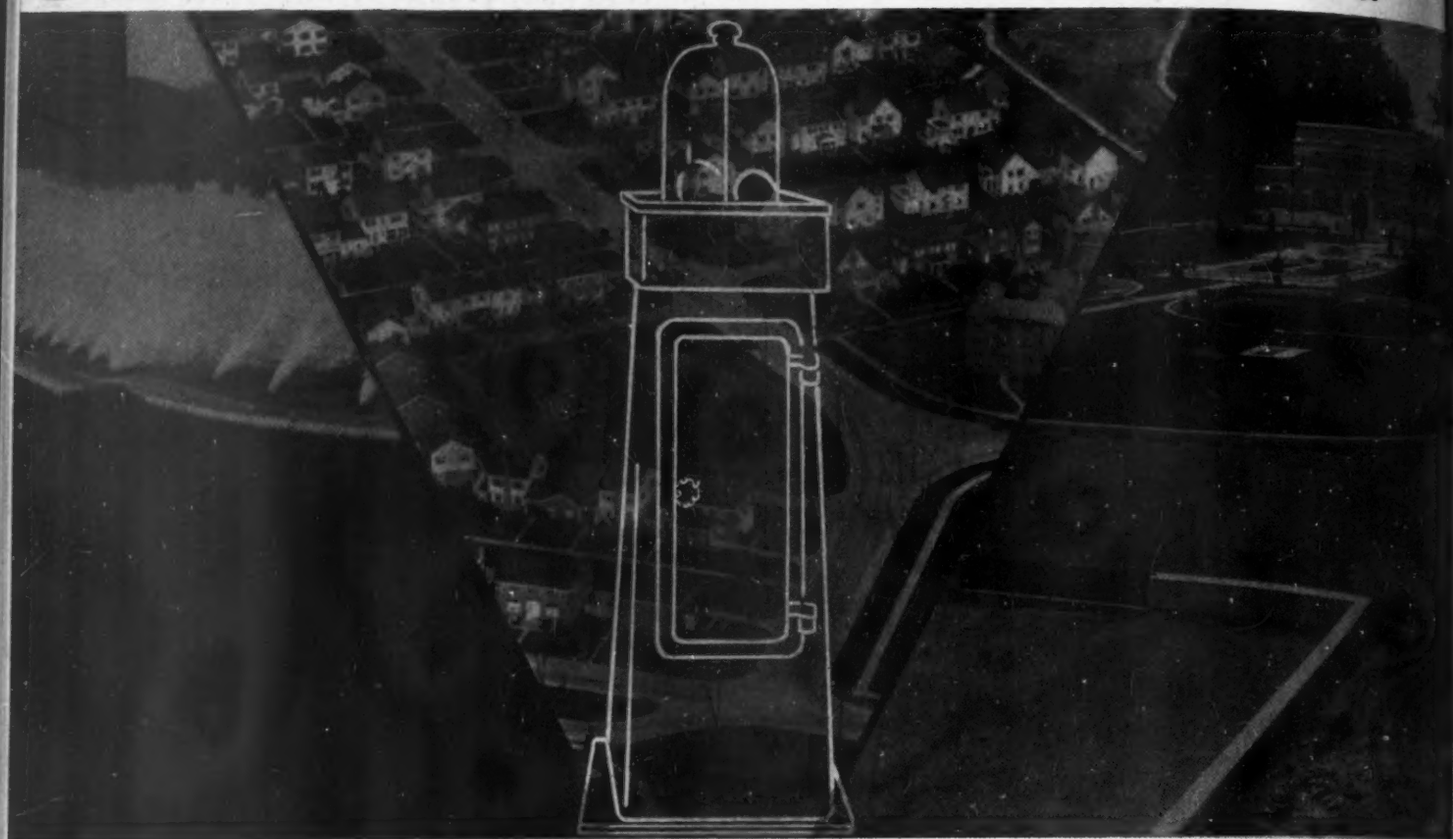
The year has seen me far afield, from the Coast and my old stamping ground in the Black Hills to Africa. The high spots of the latter were Capetown, that fine old "Tavern of the Seas"; the Rand, with its warm hospitality and its marvelous engineering work above and below ground; and, finally, a plane trip with Glen Bateman to the copper camps in Northern Rhodesia and the Congo that represent great achievements in pioneering and technology.

The technical fraternity is international and friendly all over the world. And so, speaking for my associates and myself, I send best wishes for the New Year.

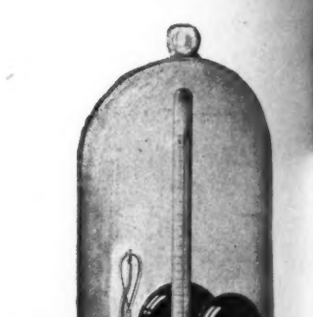
247 Park Ave., New York

DORRCO

SAVING TOMORROW'S TAX DOLLAR



THE CHLORINATION DOLLAR MUST BUY . . . DEPENDABILITY



NOT only for today but for tomorrow—for years of tomorrows—dependability is essential to chlorination. Protection of Public Health by the chlorination of water or sewage allows no halfway measures, no slipshod operation, no failure due to inadequate equipment.

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